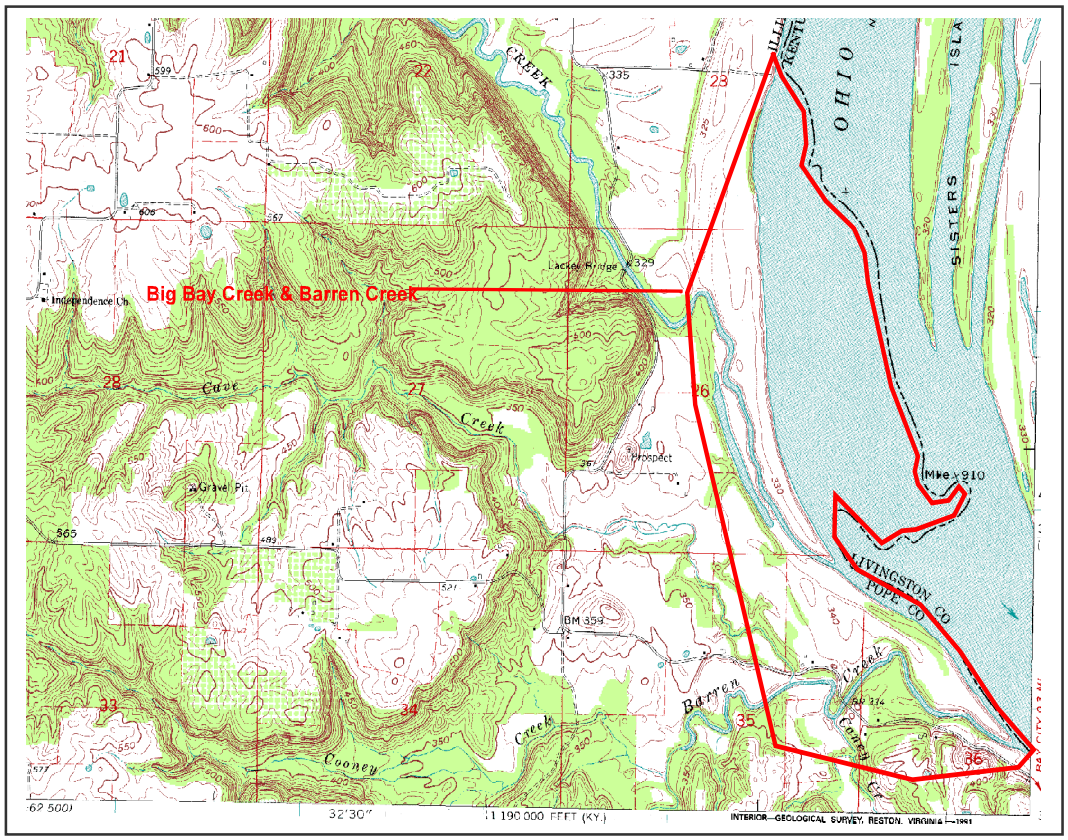
EXHIBIT H-3. EXAMPLE 2. BARREN CREEK AND BIG BAY CREEK EMBAYMENTS, ILLINOIS

EXHIBIT H-3
4.1 BARREN CREEK AND BIG BAY CREEK EMBAYMENTS (IL-10)

1.0 Location

The proposed Barren Creek and Big Bay Creek embayment project area is located in Pope County, Illinois approximately 11.6 miles northeast of Paducah, Kentucky. The project site is in the Ohio River Smithland Pool between Ohio River Mile (ORM) 909.4 and 910.9. The project site is within the jurisdiction of the Louisville District, U.S. Army Corps of Engineers (USACE).



2.0 Project Goal

The primary goal of the Barren Creek and Big Bay Creek embayment project is to provide shallow water and rock spawning habitat for fish and to restore and maintain the openings to the Barren Creek and Big Bay Creek embayments. The opening for Barren Creek would require maintenance dredging prior to the installation/construction of a rock revetment and Big Bay Creek would require the installation/construction of a rock revetment. Installation of the hard point structures would create habitat diversity for aquatic species such as fish and benthic invertebrates, especially the federally-listed endangered fat pocketbook pearly mussel (*Potamilus capax*).

3.0 Project Description and Rationale

The Barren Creek and Big Bay Creek embayment project is designed to provide shallow water and rock spawning habitat for fish and to restore and maintain the openings to the Barren Creek and Big Bay Creek embayments.

Dredging: The opening for Barren Creek would require maintenance dredging prior to the construction of a rock revetment. The opening to the embayment has been filled with silt/sediment.

Rock Structures (Hard Point Structures): Installation of the hard point structures would: 1) reduce the need for future embayment dredging by reducing sedimentation within the embayment mouths; and 2) create habitat diversity for aquatic species such as fish and benthic invertebrates, including the federally-listed endangered fat pocketbook pearly mussel.

Revetment: Big Bay Creek would require the construction of a rock revetment to protect the eroding riverbank and provide rock habitat within the project area.

4.0 Alternatives to Proposed Project

Before entering into the Ohio River, Big Bay Creek parallels the Ohio River for approximately 0.5 miles between ORM 909.5 and 910. A narrow peninsula of farmland separates Big Bay Creek and the Ohio River. The bank of the Ohio River immediately upstream from the opening of Big Bay Creek between ORM 909.5 and 910 is currently being actively eroded. The bank has little woody vegetation, and the adjacent floodplain area is being farmed up to the riverbank. Since this bank is on the outside bend of the Ohio River and since there is no natural vegetation to control the erosive forces of the river's currents, especially during high flow periods, the proposed project includes a proposal to armor the bank with rip-rap between ORM 909.5 and 910.

An alternative habitat restoration project to consider would be to cut/dredge a channel between the main channel of the Ohio River and Big Bay Creek near ORM 909.5. This channel would have to be dredged through the peninsula for approximately 400-500 feet before it could be connected with Big Bay Creek. Constructing the channel would change the narrow peninsula of farmland into an island. Since this area is on the outside bend of the Ohio River, some water flow could be diverted around the island creating a back-channel off the main Ohio River channel. Placement of a hardpoint diversion structure upstream from the proposed island could enhance the amount of flow into the channel around the newly created island. Armoring the upstream and main channel banks could stabilize the island, and the remainder of the island could be replanted with preferred bottomland hardwoods.

The primary benefits associated with this project would include increased aquatic habitat, increased terrestrial habitat due to land acquisition and habitat improvements (reforestation). The primary adverse issues to be considered with this alternative would be the requisite land acquisition or easement purchase of the peninsula, which is currently being partially farmed, and the short-term adverse affects during construction of the dredged channel.

5.0 Existing Conditions

Terrestrial/Riparian Habitat: The Illinois bank of the Ohio River between the mouths of Big Bay Creek and Barren Creek is dominated by a narrow band of riparian trees. The dominant species present in the stand include box elder (*Acer negundo*), black willow (*Salix nigra*), cottonwood (*Populus deltoides*), and silver maple (*Acer saccharinum*). The floodplain area behind the narrow riparian stand is agricultural.

A narrow peninsula of farmland separates Big Bay Creek and the Ohio River between ORM 909.5 and 910. The bank of the Ohio River immediately upstream from the opening of Big Bay Creek between ORM 909.5 and 910 is currently being actively eroded. The bank has little woody vegetation, and the adjacent floodplain area is being farmed up to the river bank. Small black willow saplings and a few scattered trees are present along the eroding bank, however the riverbank is generally dominated by herbaceous vegetation.

Aquatic Habitats: The proposed location of the Barren Creek and Big Bay Creek embayment improvements would occur along the Illinois bank of the Ohio River between ORM 909.5 and 910. A narrow littoral zone extends from the bank to approximately 5-20 yards from the bank before dropping rapidly into the main Ohio River channel. The banks are characterized by mud/silt and the bottom substrates are composed primarily of silt and fine sand. There is a complex stand of tree stumps in the littoral zone as the result of the increased water levels associated with the completion of the Smithland Dam in the early 1980's. The increased water levels in the Smithland pool transformed the affected portions of Barren and Big Bay Creeks in the project area from free flowing streams to small slackwater embayments. The increased water level killed the trees in the affected portion of the riparian zone, and the tree stumps are all that remain.

Wetlands: There are no jurisdictional wetlands present in the immediate vicinity of the proposed Barren Creek and Big Bay Creek embayment improvements. Wetlands in the vicinity of the project would be restricted to the bottomland hardwoods associated with the riparian zone adjacent to the Ohio River.

Federally-Listed Threatened and Endangered Species: According to the U.S. Fish and Wildlife Service (USFWS), there are five federally-listed threatened and endangered species known to occur in Pope County, Illinois and one species that is listed as a species of concern under a candidate conservation agreement (Table 1).

Table 1. Federally-listed species known to occur in Pope County, Illinois.

Common Name	Scientific Name	Federal Status	Potential Habitat Present
bald eagle	*Haliaeetus leucocephalus*	Threatened	yes
interior least tern	*Sterna antillarum*	Endangered	no
gray bat	*Myotis grisescens*	Endangered	no
Indiana bat	*Myotis sodalis*	Endangered	yes
fat pocketbook pearly mussel	*Potamilus capax*	Endangered	yes
copperbelly watersnake	*Nerodia erythrgaster neglecta*	Not listed (species of concern under a conservation agreement)	yes

Source: Parsons Engineering Science, 2000

Illinois State-Listed Species: According to the Illinois Department of Natural Resources (IDNR) database, there are many state-listed-species known to occur in Pope County, Illinois. The database listings for Pope County are attached in Appendix A.

Barren Creek Embayment

Big Bay Creek Embayment

6.0 Engineering Design and Requirements

6.1 Existing Ecological/Engineering Concern

The Barren Creek and Big Bay Creek mouths have become clogged with sediments due to several factors. These factors include: raised water levels from the impoundment of the Smithland Pool; which reduced the headwater currents from Barren and Big Bay Creeks near their mouths; deposition of silt from the main Ohio River Channel, especially during flood events; wave action from barge traffic; and headwater sediments from Barren Creek and Big Bay Creek. Barge traffic coupled with the scouring affects of the water velocities on the outside bend of the Ohio River has created the erosion problem north of the mouth of Big Bay Creek.

6.2 Barren Creek Embayment

Dredging - Maintenance dredging of the mouth of the embayment is required to reestablish a suitable depth for boater access and to provide a suitable sub-grade for the rock revetment at the mouth. An estimated 3,800 cubic yards of silty-clay material would be dredged to restore depths of 9-12 feet in the embayment mouth. A dredge disposal site is adjacent to the embayment. A small geotube levee 350 feet in length, would be constructed at the designated disposal site for dewatering.

Example of a Geotube Levee

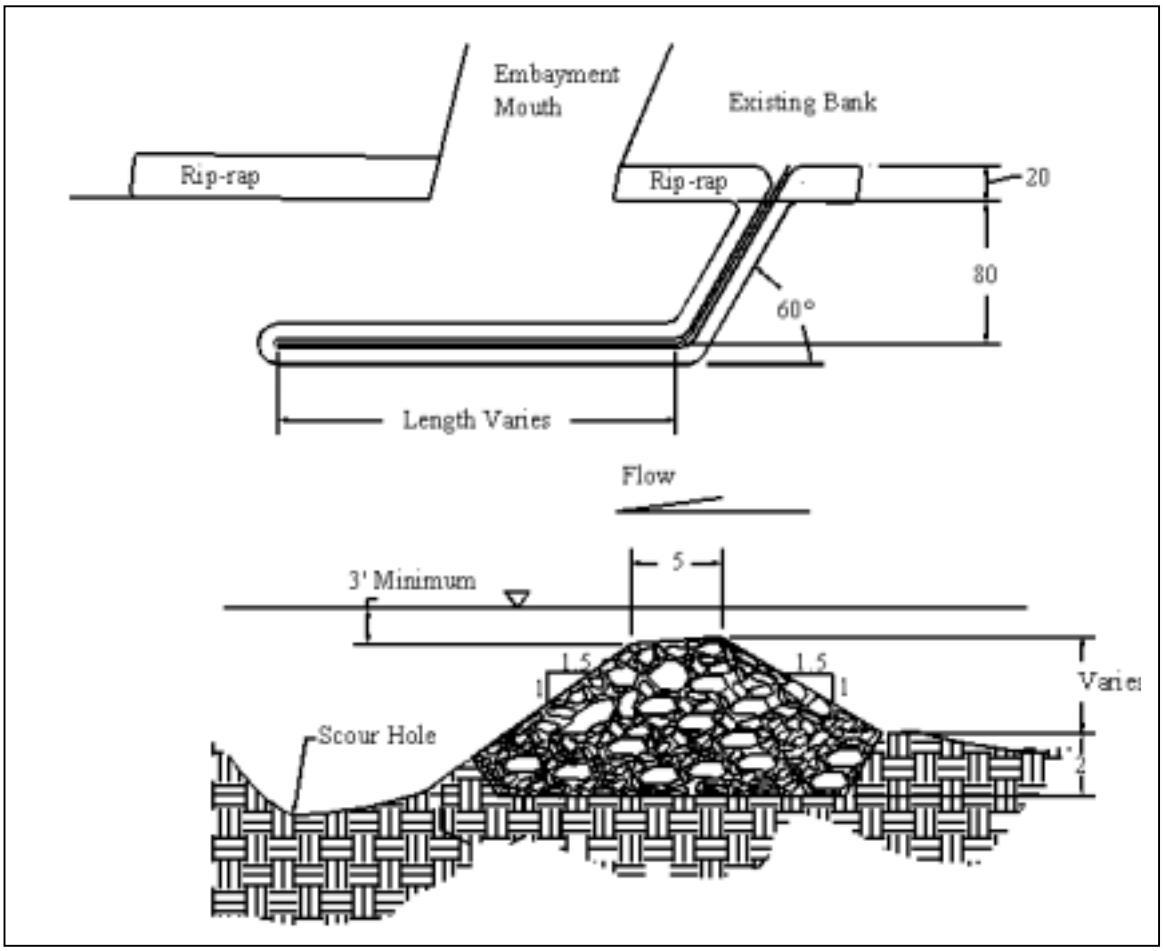
6.2.1 Embayment Rock Revetment – A rock revetment has been designed to attempt to slow the rate of sedimentation. This large rock structure would provide an area of increased velocities, which would create a scour hole at the embayment mouth. Numerical or physical modeling should be

used to evaluate the performance of the proposed structures to maintain the openings and evaluate any potential effects to navigation during the preconstruction, engineering, and design (PED) phase of the project.

Design Features:

- The structure would extend downstream at a 60-degree angle from the channel bank for 115 feet. The structure would then turn and be parallel to the bank for 220 feet (Figure 1).
- The top width is 5 feet with 1.5 to 1 side slopes.
- The dike shall be toed into the sub-grade a minimum of 2 feet and stand above the channel bottom 6 feet.
- The top of the structure shall be a minimum of 3 feet below the normal pool elevation of 324.0. A depth of 3 feet was chosen to accommodate the majority of recreational boat traffic. If deemed necessary, marker buoys would be put in place to mark the channel.
- The size of the rock used shall be uniformly graded limestone with each rock weighing between 50 and 100 pounds. Normally a well-graded rock would be used, however, a uniform gradation would provide better aquatic habitat. The use of 50-150 pound rock is included in the project design for costing purposes and is anticipated to be appropriate for the required construction. The size of rock should be determined during the preconstruction, engineering, and design (PED) phase of the project.

Figure 1. Embayment revetment detail.



6.2.2 Bank protection – Due to the increased velocities created by the embayment revetment, the channel bank would need to be protected.

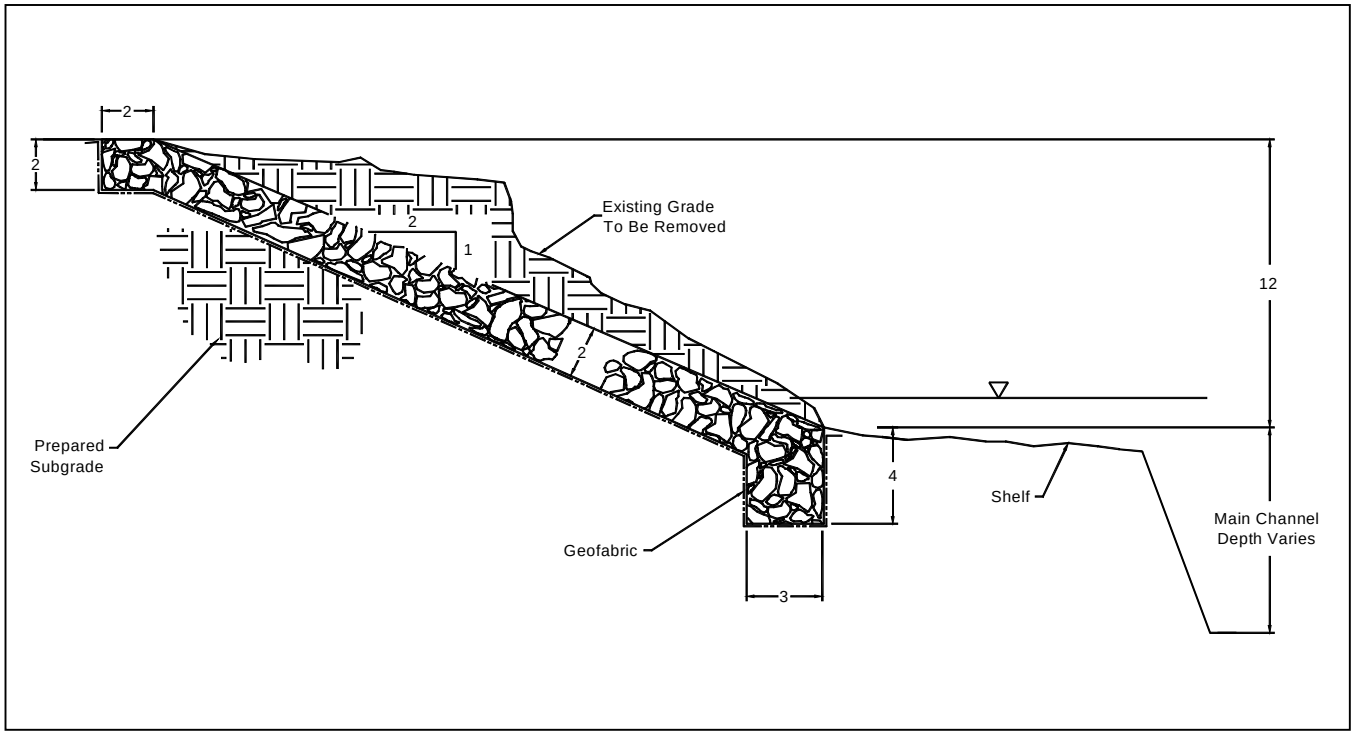
Design Features:

- Clean slope of all trees and brush
- Excavate bank to provide a 2:1 slope
- Cover slope with a filter fabric with the following properties:

Table 2. Properties of filter fabric		
Physical Property	**Test Method**	**Requirements**
Equivalent Opening Size	Corps of Engineers CWO 2215-77	Equal to greater than U.S. No. 50 Sieve
Tensile Strength @ 20% (Maximum)	VTM-52	30 lbs./linear inch (Minimum)
Puncture Strength	ASTM D751	80 lbs. (Minimum)

- Rip-rap shall extend up the banks of the channel to a height of 12 feet vertically from the channel bottom (Figure 2).

Figure 2. Bank stabilization detail.



6.3 Big Bay Creek Embayment

6.3.1 Embayment Rock Revetment – A rock revetment has been designed to attempt to slow the rate of sedimentation. This large rock structure would provide an area of increased velocities, which would create a scour hole at the embayment mouth. Numerical or physical modeling should be used to evaluate the performance of the proposed structures to maintain the openings and evaluate any potential effects to navigation during the preconstruction, engineering, and design (PED) phase of the project.

Design Features:

- The structure would extend downstream at a 60 degree angle from the channel bank for 115 feet. The structure would then turn and be parallel to the bank for 335 feet (Figure 1).
- The top width is 5 feet with 1.5 to 1 side slopes.
- The dike shall be toed into the sub-grade a minimum of 2 feet and stand above the channel bottom 6 feet.
- The top of the structure shall be a minimum of 3 feet below the normal pool elevation of 324.0. A depth of 3 feet was chosen to accommodate the majority of recreational boat traffic. If deemed necessary, marker buoys would be put in place to mark the channel.
- The size of the rock used shall be uniformly graded limestone with each rock weighing between 50 and 100 pounds. Normally a well-graded rock would be used, however, a uniform gradation would provide better aquatic habitat.

6.3.2 Bank protection – Due to the increased velocities created by the embayment revetment, the channel bank would need to be protected.

Design Features:

- Clean slope of all trees and brush
- Excavate bank to provide a 2:1 slope
- Cover slope with a filter fabric with the following properties:

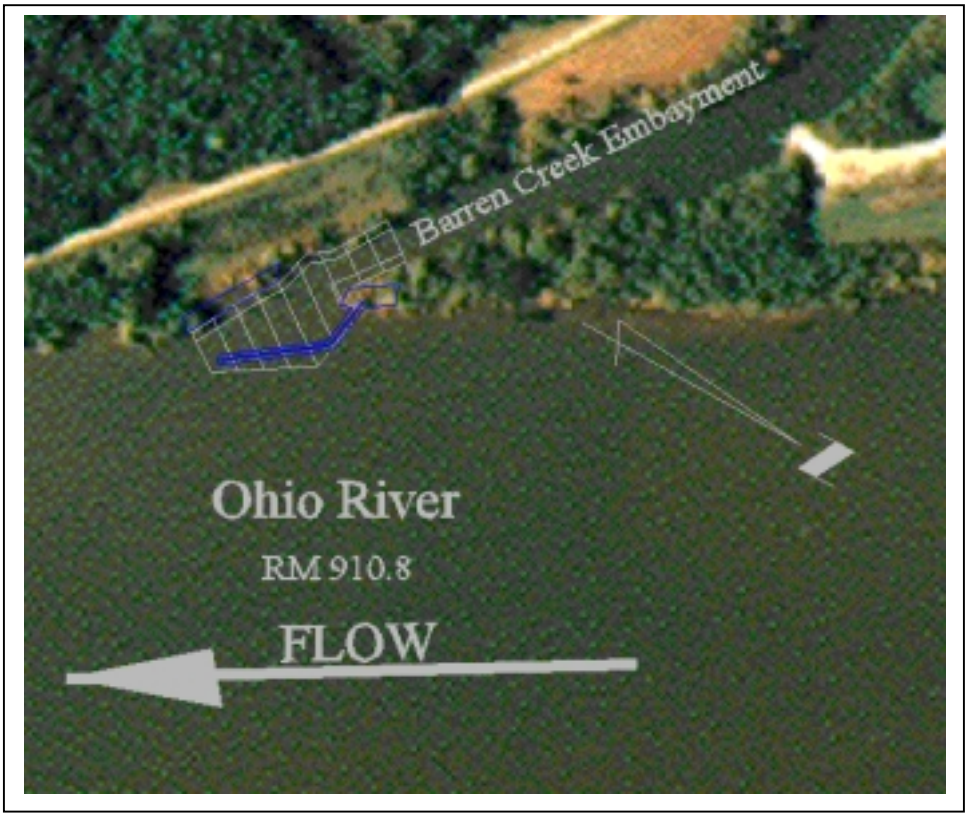
Table 3. Properties of filter fabric

Physical Property	Test Method	Requirements
Equivalent Opening Size	Corps of Engineers CWO 2215-77	Equal to greater than U.S. No. 50 Sieve
Tensile Strength @ 20% (Maximum)	VTM-52	30 lbs./linear inch (Minimum)
Puncture Strength	ASTM D751	80 lbs. (Minimum)

- Rip-rap shall extend up the banks of the channel to a height of 12 feet vertically from the channel bottom (Figure 2).

7.0 Project Diagram

7.1. Barren Creek Embayment



7.2. Big Bay Creek Embayment

8.0 Planning/Engineering Assumptions

8.1 Barren Creek Embayment

- Average channel velocities are 3 feet per second.
- All rip-rap material would be shipped by barge to the project site. All costs for shipping are included in the material costs.
- A small swinging ladder, cutterhead dredge machine is used for all dredging.

8.2 Big Bay Creek Embayment

- Average channel velocities are 3 feet per second.
- All rip-rap material would be shipped by barge to the project site. All costs for shipping are included in the material costs.

8.3 Environmental

- Mussel surveys of project areas should be accomplished prior to the start of any work to ensure that threatened or endangered mussel species will not be affected.

9.0 Cost Estimate (Construction and Land Acquisition):

9.1 Barren Creek Embayment - Construction costs for the proposed project are contained on Table 4. A detailed MCACES cost estimate for the proposed project **is** included in Appendix D.

Table 4. Construction Costs	
Item	**Cost**
Dredging	$11,700
Embayment Revetment	$94,400
Mobilization and Contingencies @ 20%	$21,200
Mussel Survey	$5,000
TOTAL	**$ 132,300**

9.2 Big Bay Creek Embayment - Construction costs for the proposed project are contained on Table 5. A detailed MCACES cost estimate for the proposed project **is** included in Appendix D.

Table 5. Construction Costs	
Item	**Cost**
Embayment Revetment	$58,400
Bank Protection	$250,300
Mobilization and Contingencies @ 20%	$61,800
Mussel Survey	$5,000
TOTAL	**$ 375,400**

10.0 Schedule:

10.1 Barren Creek Embayment - The estimated construction time for this project is shown on Table 6.

Table 6. Construction Schedule.	
Item	**Time**
Mobilization	5 Days
Dredging	9 Days
Embayment Revetment	10 Days
Protection and Restoration	2 Days
TOTAL	**26 Days**

10.2 Big Bay Creek Embayment – The estimated construction time for this project is shown on Table 7.

Table 7. Construction Schedule.	
Item	**Time**
Mobilization	5 Days
Embayment Revetment	6 Days
Bank Protection	30 Days
Protection and Restoration	3 Days
TOTAL	**44 Days**

11.0 Expected Ecological Benefits

Terrestrial/Riparian Habitat: The Barren Creek and Big Bay Creek embayment improvements would be constructed on or adjacent to the Illinois bank of the Ohio River near the mouths of Barren Creek and Big Bay Creek. Protecting/armoring the bank upstream from Big Bay Creek and near the rock revetments associated with the mouths of Barren and Big Bay Creeks would insure that the terrestrial/riparian habitats are not eroded by the Ohio River currents. Bank stabilization at these locations would be considered a long-term beneficial impact to terrestrial/riparian habitats.

Aquatic Habitats: The structure of the rip-rap dike coupled with localized changes in flow patterns and the scouring effects downstream from the rock revetments would lead to improved habitat diversity for aquatic species. Dredging of the mouth of Barren Creek would result in long-term beneficial impacts to fishes due to the improved/deepened access to the Barrens Creek Embayment. Fishes would be allowed free access to the embayment, especially during low flow periods. Since habitat requirements may change seasonally, improved access to the embayment coupled with the long-term scouring of the mouth of the embayment from the placement of the rock revetment would be considered beneficial.

The riverbank is characterized by mud/silt, and the bottom substrates are composed primarily of silt and fine sand. The aquatic habitats in the immediate vicinity of the proposed revetment locations are characterized by a narrow littoral zone that extends from the bank to approximately 5-20 yards from the bank before dropping rapidly into the main Ohio River Channel. There is a stand of tree stumps in the littoral zone, which provides quality habitat for various aquatic species, especially fish. The addition of the hard substrate (rip-rap) would result in long-term beneficial impacts to aquatic species due to the increase in the habitat diversity.

Wetlands: There would be no reasonably foreseeable beneficial impacts to jurisdictional wetlands as a result of constructing the Barren Creek and Big Bay Creek embayment improvements.

Federally-Listed Threatened and Endangered Species: Following the construction of the revetments, it is anticipated that the effects of the Ohio River currents flowing over the structures during high flow periods would result in the formation of a scour hole immediately downstream from the revetment. The effects to the altered bathymetry and the addition of rock substrate may be beneficial for benthic invertebrate populations in the project area.

There would be no reasonably foreseeable beneficial impacts to Indiana bats, gray bats, bald eagles, or copperbelly watersnakes as a result of constructing the Barren Creek and Big Bay Creek embayment improvements.

Illinois State-Listed Species: The only state-listed species that could be impacted by the proposed project would be the ebonyshell (*Fusconaia ebena*), which is a freshwater mussel that is considered a species of special concern in Illinois. Beneficial impacts to state-listed freshwater mussels would be similar to those impacts discussed above for the fat pocketbook pearly mussel.

Socioeconomic Resources: There would be short-term and long-term beneficial impacts to socioeconomic resources as a result of implementing Barren Creek and Big Bay Creek embayment improvements. The short-term beneficial impacts would be related to costs and local expenditures associated with the construction and dredging operation.

Potential Adverse Environmental Impacts

Terrestrial/Riparian Habitat: During the dredging operation and construction of the revetments, there would be a potential for short-term adverse impacts to terrestrial species from construction-related noise and disturbance. Considering the existing high volume of disturbance from barge traffic along the Ohio River and recreational boat usage in Barren and Big Bay Creeks, it is likely that the increased noise/disturbance impacts would be very minor.

Depending upon the placement of dredge material, there may be localized adverse impacts to terrestrial species. There would be minor short-term adverse impacts to terrestrial/riparian vegetation during construction of the rip-rap bank stabilization.

Aquatic Habitats: There would be a potential for adverse affects to aquatic species, especially immobile benthic invertebrates during the construction of the Barren Creek and Big Bay Creek embayment improvements. Localized populations of benthic invertebrates could be covered with rip-rap during the construction of the revetments. In addition, sensitive aquatic species immediately downstream from the dredge site could be adversely impacted by degraded water quality associated with displaced sediments. As presently envisioned, approximately 3,800 cubic yards of sediments would be removed from the mouth of Barrens Creek. The adverse impacts to aquatic species would be short term, and the overall beneficial impacts of the restoration project would outweigh the adverse impacts. When considering the amount of sediment that is displaced annually in the Ohio River system by maintenance dredging of the navigation channel, the additional dredging of Barrens Creek would be considered inconsequential.

Wetlands: There would be no adverse affects to jurisdictional wetlands as a result of constructing the Barren Creek and Big Bay Creek improvements.

Federally-Listed Threatened and Endangered Species: There would be a potential for adverse effects to the fat pocketbook pearly mussel during the construction of the Barren Creek

and Big Bay Creek embayment improvement. If present, individual mussels or localized populations could be covered with rip-rap during the construction of the revetments. In addition, mussels immediately downstream from the construction/dredge site could be adversely impacted by perturbed water quality conditions associated with displaced sediments. Adverse impacts to fat pocketbook pearly mussels could be minimized by conducting surveys and potentially relocating the endangered mussels prior to construction.

It would be unlikely that the Indiana bat, gray bat, bald eagle, copperbelly watersnake, or the interior least tern would be adversely affected by the construction of the Barren Creek and Big Bay Creek embayment improvements.

Illinois State-Listed Species: According to the Illinois Department of Natural Resources (IDNR) database, there are many state-listed-species known to occur in Pope County, Illinois, and these species are listed in Appendix A. The only state-listed species that could be adversely impacted by the proposed project would be the ebonyshell (*Fusconaia ebena*), which is a freshwater mussel that is considered a species of special concern in Illinois. Adverse impacts to state-listed freshwater mussels would be similar to those impacts discussed above for the fat pocketbook pearly mussel.

Socioeconomic Resources: There would be no reasonable foreseeable adverse socioeconomic impacts as a result of implementing the Barren Creek and Big Bay Creek embayment improvements.

12.0 Mitigation

Minor impacts associated with dredging and rock placement may occur during the construction of this project. No significant adverse impacts are expected. Adverse impacts associated with dredge material placement can be minimized by using effective dewatering procedures (if land disposal occurs) to reduce siltation/turbidity that may have a short-term adverse impact on local water quality. Prior to the placement of the rock structures, mussel surveys (including requisite mussel relocations), should be conducted to assure that no impacts would occur to threatened and/or endangered mussels in the area.

13.0 Preliminary Operation and Maintenance Costs

13.1 Barren Creek Embayment - Operation and Maintenance costs are summarized on Table 8.

Table 8. Operation and Maintenance Costs (50 Year Life)

Maintenance	Frequency	Costs
Dredging	5 years	$35,100
Repair of Rock Revetment	10 years	$47,200

13.2 Big Bay Creek Embayment - Operation and Maintenance costs are summarized on Table 9.

Table 9. Operation and Maintenance Costs (50 Year Life)		
Maintenance	**Frequency**	**Costs**
Repair of Bank Protection	10 Years	$125,150
Repair of Rock Revetment	10 years	$29,200

14.0 Potential Cost Share Sponsor(s)

- State of Illinois
- The Nature Conservancy
- barge/towing industry
- U.S. Fish & Wildlife Service

15.0 Expected Life of the Project

The life expectancy of the project is estimated to be 50 years.

17.0 Hazardous, Toxic, and Radiological Waste Considerations

Potential impacts of hazardous, toxic, and radiological waste (HTRW) at the site were visually assessed during a site visit and further assessed via a database search of HTRW records in the project area.

Site Inspection Findings

The project site is on the east side of the Ohio River between River Miles 910 and 910.7. The site involves areas where Big Bay Creek (River Mile 910) and Barren Creek (River Mile 910.7) flow to the river from Illinois. There are no cities/towns in Illinois or Kentucky within a 1.5 mile radius of the project area. Project site owners are of the Federal Government, State of Illinois, and Pope County, Illinois.

The following environmental conditions were considered when conducting the June 3, 1999 project area inspection:

- Suspicious/Unusual Odors;
- Discolored Soil;
- Distressed Vegetation;
- Dirt/Debris Mounds;
- Ground Depressions;
- Oil Staining;
- Above Ground Storage Tanks (ASTs);
- Underground Storage Tanks (USTs);
- Landfills/Wastepiles;
- Impoundments/Lagoons;
- Drum/Container Storage;
- Electrical Transformers;
- Standpipes/Vent pipes;
- Surface Water Discharges;
- Power or Pipelines;
- Mining/Logging;
- Other

None of the environmental conditions listed above were observed in the project area.

Risk Management Data Search

A search of available environmental records was conducted by Environmental Data Resources, Inc. (EDR). The search complied with ASTM Standard Practice for Environmental Site Assessments, E 1527-97. The search report with maps showing the search area around the project site is presented in Appendix B. The search distance was configured to include the area of the project and an extended buffer zone beyond the boundary of the project. It was conservatively assumed that any environmental conditions beyond the project area buffer zone would not impact the project. Databases searched and the distance searched from the project site for each environmental item (e.g., USTs, NPL sites, etc.) are as follows:

Databases	Search Radius (Miles)
NPL: National Priority List	1.50
RCRIS-TSD: Resource Conservation and Recovery Information System	1.00
SHWS: State Hazardous Waste Sites	1.50
CERCLIS: Comprehensive Environmental Response, Compensation, and Liability Information System	1.00
CORRACTS: Corrective Action Report	1.50
SWF/LF: Available Disposal for Solid Waste in Illinois- Solid Waste Landfills Subject to State Surcharge	1.00
LUST: Leaking Underground Storage Tank	1.00
UST: Underground Storage Tank	0.75
RCRIS-SQG: Resource Conservation and Recovery Information System for Small Quantity Generators	0.75
RCRIS-LQG: Resource Conservation and Recovery Information System for Large Quantity Generators	0.75
Plan Comm: Illinois Planning Commission	1.00
ROD: Record of Decision	1.50
CONSENT: Superfund (CERCLA) Consent Decrees	1.50
Coal Gas: Former Manufactured gas (Coal Gas) Sites	1.50
MINES: Mines Master Index File	0.75

The environmental records search revealed a power transmission line crossing the Ohio River at about River Mile 910.75; however, none of the conditions listed above were found in or around the project area at the distances specified.

HTRW Findings and Conclusions

An inspection of the project site and a search of environmental records relevant to the project site and extended areas beyond have revealed no evidence of recognized environmental problem conditions in connection with this project site.

18.0 Photo Log

Upstream bank of the Big Bay Creek Embayment

Downstream bank of the Big Bay Creek Embayment

Barren Creek Embayment Mouth

Barren Creek Embayment Boat Ramp

APPENDIX A Threatened & Endangered Species

United States Department of the Interior
FISH AND WILDLIFE SERVICE
MARION, ILLINOIS SUBOFFICE (ES)
8588 ROUTE 148
MARION, ILLINOIS 62959

PHONE: (618)997-3344FAX: (618)997-8961

FACSIMILE TRANSMITTAL

TO: Karen Boulware PHONE #: 314/576-7330

FROM: Joyce Collins DATE: 6/25/99

SUBJECT: Endangered Species List PG 1 OF 5

NOTES

DISTRIBUTION OF FEDERALLY-LISTED THREATENED (T), ENDANGERED (E), AND PROPOSED (P) SPECIES
ILLINOIS

Revised July 8,1998

BIRDS	STATUS	HABITAT	CURRENT DISTRIBUTION	POTENTIAL HABITAT	HISTORICAL RECORDS
Peregrine falcon *Falco peregrinus*	E	Breeding: Tops of buildings bridges/rocky cliffs	Cook	Rock Island	
Bald eagle *Haliaeetus leucocephalus*	T	Breeding: Large rivers, lakes, reservioes	Adams, Alexander, Bond. Calhoun Carroll, Fayette, Greene, Jo Daviess, Jackson, Mason, Pike, Pope, Randolph, St. Clair, Union, Williamson	Hancock, Jasper	
		Wintering:	Adams, Alexander, Brown, Bureau, Calhoun, Carroll, *Cass, Christian, Clinton, De Witt, Fayette, Franklin, *Fulton, Greene, Grundy, Hancock, *Henderson, Jackson, Jasper, Jefferson, *Jersey, Jo Daviess, Johnson, LaSalle, Madison, Marshall, Mason, McHenry, Menard, *Mercer, Monroe, *Morgan, Moultrie, Ogle, Peoria, Pike, Pulaski, *Putnam, Randolph, *Rock Island, Sangamon, *Schuyler, Scott, Shelby, St. Clair, Tazewell, Union, Wabash, White, *Whiteside, Will, Winnebago, Williamson, Woodford * Counties with night roosts		
Least tern *Sterna antillarum*	E	Bare alluvial and dredge spoil islands	Alexander, Jackson, Massac, Pope (Mississippi and Ohio Rivers)	Gallatin, Hardin, Pulaski (Ohio River) Wabash, White (Wabash R.), Madison (Mississippi River)	Cook, Gallatin, Lake, Madison, Pope
Piping Plover *Charadrius melodus* (Great Lakes Drainage)	E	Lakeshore beaches	EXTIRPATED	Lake, Cook, (Lake Michigan shoreline)	

FISH	STATUS	HABITAT	CURRENT DISTRIBUTION	POTENTIAL HABITAT	HISTORICAL RECORDS
Pallid sturgeon Scaphirhynchus albus	E	Rivers	Alexander,Randolph (Mississippi River) **All counties below Missouri River confluence** (Madison, Monroe, Jackson Union, St. Clair)	Ohio River below dam #53	Calhoun, Hancock, Henderson

DISTRIBUTION OF FEDERALLY-LISTED THREATENED (T), ENDANGERED (E), AND PROPOSED (P) SPECIES
ILLINOIS

MUSSELS	STATUS	HABITAT	CURRENT DISTRIBUTION	POTENTIAL HABITAT	HISTORICAL RECORDS
Fanshell mussel *Cyprogenia stegaria* (=*C. irrorata*)	E	Rivers	White (Wabash River)	Gallatin (Wabash River)	
Fat pocketbook pearly mussel *Potamilus capax*	E	Rivers	*Hancock, *Pike (Mississippi River), Gallatin, Lawrence, Wabash, White, (Wabash & Little Wabash Rivers) Pope, Massac (Ohio River) *Transplanted populations		
Higgins' eye pearly mussel *Lampsilis higginsi*	E	Rivers	Jo Daviess, Rock Island, Mercer, Henderson (Mississippi river); Rock River below Steel Dam at Milan	Adams, Carroll, Hancock, Pike, Whiteside, (Mississippi River upstream of Lock and Dam 22)	
			Essential Habitat: Rock Island (Sylvan Slough)		
Pink mucket pearly mussel *Lampsilis orbiculata* (=*P. abrupta*)	E	Rivers	Massac (Ohio River)	Alexander, Gallatin, Hardin, Pope, Pulaski (Ohio River)	
Tubercled-blossom pearly mussel *Epioblasma torulosa torulosa*	E	Rivers	EXTIRPATED		Clark, Crawford, Lawrence, Wabash (Wabash River)
Orange-footed pearly mussel *Plethobasis cooperianus* (=*P. striatus*)	E	Rivers	Massac, Pulaski (Ohio River)	Alexander, Pope (Ohio River below mouth of Cumberland River)	
White warty -back pearly mussel *Plethobasis cicatricosus*	E	Rivers	EXTIRPATED	Clark, Gallatin, White (Wabash River)	
Clubshell *Pleurobema clava*	E	Rivers	Vermilion County (N. Fork Vermilion River)	N. Fork Vermilion River	Clark, Crawford, Lawrence, Vermillion, Wabash (Wabash River)
Rough pigtoe Pleurobema plenum	E	Rivers	EXTIRPATED		Wabash River and Lower Ohio River
Ring Pink *Obovaria retusa*	E	Rivers	EXTIRPATED		Wabash River and Lower Ohio River

DISTRIBUTION OF FEDERALLY-LISTED THREATENED (T), ENDANGERED (E), AND PROPOSED (P) SPECIES
ILLINOIS

MUSSELS	STATUS	HABITAT	CURRENT DISTRIBUTION	POTENTIAL HABITAT	HISTORICAL RECORDS
Fanshell mussel *Cyprogenia stegaria* (=*C. irrorata*)	E	Rivers	White (Wabash River)	Gallatin (Wabash River)	
Fat pocketbook pearly mussel *Potamilus capax*	E	Rivers	*Hancock, *Pike (Mississippi River), Gallatin, Lawrence, Wabash, White, (Wabash & Little Wabash Rivers) Pope, Massac (Ohio River) *Transplanted populations	N. Fork	
Higgins' eye pearly mussel *Lampsilis higginsi*	E	Rivers	Jo Daviess, Rock Island, Mercer, Henderson (Mississippi river); Rock River below Steel Dam at Milan	Adams, Carroll, Hancock, Pike, Whiteside, (Mississippi River upstream of Lock and Dam 22)	
			Essential Habitat: Rock Island (Sylvan Slough)		
Pink mucket pearly mussel *Lampsilis orbiculata* (=*P. abrupta*)	E	Rivers	Massac (Ohio River)	Alexander, Gallatin, Hardin, Pope, Pulaski (Ohio River)	
Tubercled-blossom pearly mussel *Epioblasma torulosa torulosa*	E	Rivers	EXTIRPATED		Clark, Crawford, Lawrence, Wabash (Wabash River)
Orange-footed pearly mussel *Plethobasis cooperianus* (=*P. striatus*)	E	Rivers	Massac, Pulaski (Ohio River)	Alexander, Pope (Ohio River below mouth of Cumberland River)	
White warty -back pearly mussel *Plethobasis cicatricosus*	E	Rivers	EXTIRPATED	Clark, Gallatin, White (Wabash River)	
Clubshell *Pleurobema clava*	E	Rivers	Vermilion County (N. Fork Vermilion River)	N. Fork Vermilion River	Clark, Crawford, Lawrence, Vermillion, Wabash (Wabash River)
Rough pigtoe *Pleurobema plenum*	E	Rivers	EXTIRPATED		Wabash River and Lower Ohio River
Ring Pink *Obovaria retusa*	E	Rivers	EXTIRPATED		Wabash River and Lower Ohio River

DISTRIBUTION OF FEDERALLY-LISTED THREATENED (T), ENDANGERED (E), AND PROPOSED (P) SPECIES
ILLINOIS

PLANTS	STATUS	HABITAT	CURRENT DISTRIBUTION	POTENTIAL HABITAT	HISTORICAL RECORDS
Small whorled pogonia *Isotria medeoloides*	T	Dry woodland	Randolph		
Prairie bush-clover *Lespedeza leptostachya*	T	Dry to mesic prairies with gravelly soil	Cook, Dupage, Lee, Ogle, McHenry, *Winnebago, *=Introduced	**Search for this Species whenever prairie remnants are encountered**	
Running buffalo clover *Trifolium stoloniferum*	E	Disturbed bottomland meadows	EXTIRPATED		St. Clair, Tazewell Williamson
Lakeside daisy *Hymenoxis herbacea*	T	Dry rocky prairies	* Tazewell, * Will * = Introduced		
Mead's milkweed *Asclepias meadii*	T	Virgin prairies	* Ford, Saline	**Search for this species whenever prairie remnants are encountered**	Cook, Fulton, Hancock, Henderson, Peoria
Decurrent false aster *Boltonia decurrens*	T	Disturbed alluvial soils	St. Clair (Mississippi River floodplain); Bureau, Fulton, Jersey, Madison, Marshall, Mason, Morgan, Peoria, Pike, Putnam, Schuyler, Scott, Tazewell Woodford (Illinois river floodplain)	Brown, Calhoun, Cass, Green, Grundy LaSalle, Pike, (Illinois River floodplain) Alexander, Jackson, Monroe, Randolph, (Mississippi River floodplain)	Logan, Menard
Eastern prairie fringed orchid *Platanthera leucophaea*	T	Mesic to wet prairies	Cook, Dupage, Grundy, Henry, Iroquois, Kane, Lake, McHenry	**Search for this species whenever Prairie remnants are encountered**	Adams, Champaign, DeKalb, Fayette, Fulton, Ford, Hancock, Henderson, Jo Daviess, Kankakee, Knox, Lee Macon, Macoupin, Madison, McDonough, McLean, Union Menard, Ogle, Peoria, Stark, Stevenson. Will, Winnebago,
Price's potato bean *Apios priceana*	T	Wet floodplain forests, shrubby swamps	EXTIRPATED		Union
Leafy prairie clover *Dalea foliosa*	E	Prairie remnants on thin soil over limestone	Will (Des Plaines River floodplain)		Boone, Kane, LaSalle, Kankakee, Ogle
Dune Thistle *Cirsium pitcheri*	T	Lakeshore dunes	Lake (Introduced)		Cook

Illinois
Department of
Natural Resources
524 South Second Street • Springfield, Illinois 62701-1787
http://dnr.state.il.us
George H. Ryan, Governor • Brent Manning, Director

JUN 2 5

June 22, 1999

Karen Boulware
400 Woods Mill Road, Suite 330
Chesterfield, MO 63017

Dear Ms. Boulware:

Per your telephone request, I have enclosed a list of Illinois endangered and threatened species that have been recorded from Massac and Pope counties in extreme southern Illinois.

A few notes about the list. Many species are listed repeatedly. This reflects the fact that the species has been recorded from more than one location in the county. You will also notice that counties other than Massac and Pope appear on the list. This results from locations that straddle a county line and consequently are listed twice in our database. The right-hand column in the table shows the date on which the species was last observed at a given location. The appearance of a long-ago date in this column does not necessarily mean that the species is no longer present. It may only indicate that the location has not been checked for some time.

If you need other categories of information about endangered and threatened species in Massac and Pope counties, please let me know. You can reach me by phone at (217)785-8774 or by e-mail at gkruse@dnrmail.state.il.us.

Sincerely,

Glen Kruse

Glen Kruse
Program Manager
Endangered and Threatened Species

Enclosures

COUNTYNAME:.	SCI. NAME:.....	COMMON NAME:.....	LASTOBS...
Hardin	FUSCONAIA EBENA	EBONYSHELL	1994
Johnson	LONTRA CANADENSIS	RIVER OTTER	1991-12
Massac	ARISTOLOCHIA SERPENTARIA VAR HASTATA	NARROW-LEAVED SNAKEROOT	1986-09-02
Massac	ARISTOLOCHIA SERPENTARIA VAR HASTATA	NARROW-LEAVED SNAKEROOT	1986-09-17
Massac	BUTEO LINEATUS	RED-SHOULDERED HAWK	1997-04-28
Massac	CAREX GIGANTEA	LARGE SEDGE	1976
Massac	CAREX RENIFORMIS	RENIFORM SEDGE	1987
Massac	CAREX RENIFORMIS	RENIFORM SEDGE	1991-05-28
Massac	CUMBERLANDIA MONODONTA	SPECTACLE CASE MUSSEL	1994-08-18
Massac	CYCLONAIAS TUBERCULATA	PURPLE WARTYBACK	1998-09-30
Massac	CYCLONAIAS TUBERCULATA	PURPLE WARTYBACK	1998-12-04
Massac	CYPERUS LANCASTRIENSIS	GALINGALE	1985
Massac	ELLIPSARIA LINEOLATA	BUTTERFLY	1998-09-30
Massac	ELLIPSARIA LINEOLATA	BUTTERFLY	1994-08-18
Massac	ELLIPSARIA LINEOLATA	BUTTERFLY	1998-09-12
Massac	ELLIPSARIA LINEOLATA	BUTTERFLY	1998-12-04
Massac	ELLIPSARIA LINEOLATA	BUTTERFLY	1998-09-03
Massac	ELLIPTIO CRASSIDENS	ELEPHANT-EAR MUSSEL	1998-12-04
Massac	ELLIPTIO CRASSIDENS	ELEPHANT-EAR MUSSEL	1987-07
Massac	ELLIPTIO CRASSIDENS	ELEPHANT-EAR MUSSEL	1998-09-30
Massac	ELLIPTIO CRASSIDENS	ELEPHANT-EAR MUSSEL	1997-10-27
Massac	ELLIPTIO CRASSIDENS	ELEPHANT-EAR MUSSEL	1998-09-12
Massac	ELLIPTIO DILATATA	SPIKE	1998-09-30
Massac	ERYNGIUM PROSTRATUM	ERYNGO	1998-05-18
Massac	EUPATORIUM INCARNATUM	THOROUGHWORT	1988-11-30
Massac	FUSCONAIA EBENA	EBONYSHELL	1994-08-18
Massac	FUSCONAIA EBENA	EBONYSHELL	
Massac	FUSCONAIA EBENA	EBONYSHELL	1998-12-04
Massac	FUSCONAIA EBENA	EBONYSHELL	1998-08-30
Massac	FUSCONAIA EBENA	EBONYSHELL	1998-09-03

Massac	GALACTIA MOHLENBROCKII	BOYKIN'S DIOCLEA	1993-05-21
Massac	GALACTIA MOHLENBROCKII	BOYKIN'S DIOCLEA	1985
Massac	GALACTIA MOHLENBROCKII	BOYKIN'S DIOCLEA	1994-07-03
Massac	GALLINULA CHLOROPUS	COMMON MOORHEN	1990-06-28
Massac	GAMMARUS BOUSFIELDI	AMPHIPOD	1981-03-18
Massac	GAMMARUS BOUSFIELDI	AMPHIPOD	1976-08-12
Massac	HALESIA CAROLINA	SILVERBELL TREE	1974
Massac	HALESIA CAROLINA	SILVERBELL TREE	1988-11-30
Massac	HALESIA CAROLINA	SILVERBELL TREE	1994-07-03
Massac	HELIANTHUS ANGUSTIFOLIUS	NARROW-LEAVED SUNFLOWER	1986
Massac	HELIANTHUS ANGUSTIFOLIUS	NARROW-LEAVED SUNFLOWER	1965
Massac	HELIANTHUS ANGUSTIFOLIUS	NARROW-LEAVED SUNFLOWER	1986
Massac	ICTINIA MISSISSIPPIENSIS	MISSISSIPPI KITE	1992-06-17
Massac	IRESINE RHIZOMATOSA	BLOODLEAF	1997
Massac	IXOBRYCHUS EXILIS	LEAST BITTERN	1991-07-20
Massac	LAMPSILIS ABRUPTA	PINK MUCKET	1998-09-30
Massac	LAMPSILIS ABRUPTA	PINK MUCKET	1997
Massac	LANIUS LUDOVICIANUS	LOGGERHEAD SHRIKE	1990
Massac	LANIUS LUDOVICIANUS	LOGGERHEAD SHRIKE	1990-05-27
Massac	LEPOMIS MINIATUS	REDSPOTTED SUNFISH	1987-07-14
Massac	LEPOMIS MINIATUS	REDSPOTTED SUNFISH	1987-07-15
Massac	LIGUMIA RECTA	BLACK SANDSHELL	1998-12-04
Massac	LIGUMIA RECTA	BLACK SANDSHELL	1998-09-12
Massac	LIGUMIA RECTA	BLACK SANDSHELL	1998-09-03
Massac	LONTRA CANADENSIS	RIVER OTTER	1993
Massac	LONTRA CANADENSIS	RIVER OTTER	1995-02-15
Massac	MELANTHERA NIVEA	WHITE MELANTHERA	1970'S
Massac	MELANTHERA NIVEA	WHITE MELANTHERA	1997
Massac	MELICA MUTICA	TWO-FLOWERED MELIC GRASS	1993-05-21
Massac	MELICA MUTICA	TWO-FLOWERED MELIC GRASS	1990
Massac	MELICA MUTICA	TWO-FLOWERED MELIC GRASS	1994-07-03
Massac	NERODIA ERYTHROGASTER NEGLECTA	COPPERBELLY WATER SNAKE	1991

Massac	NERODIA ERYTHROGASTER NEGLECTA	COPPERBELLY WATER SNAKE	1995-04-16
Massac	NOTROPIS MACULATUS	TAILLIGHT SHINER	1988-07-19
Massac	NOTURUS STIGMOSUS	NORTHERN MADTOM	1997-10-11
Massac	ORCONECTES PLACIDUS	CRAYFISH	1998-08-29
Massac	ORCONECTES PLACIDUS	CRAYFISH	1988-06-10
Massac	ORCONECTES PLACIDUS	CRAYFISH	1998-08-28
Massac	ORYZOMYS PALUSTRIS	MARSH RICE RAT	1987-04-02
Massac	ORYZOMYS PALUSTRIS	MARSH RICE RAT	1998-08-23
Massac	ORYZOMYS PALUSTRIS	MARSH RICE RAT	1998-08-22
Massac	PANDION HALIAETUS	OSPREY	1998-05-25
Massac	PLANERA AQUATICA	WATER ELM	1987
Massac	PLANERA AQUATICA	WATER ELM	1980
Massac	PLATANTHERA FLAVA VAR FLAVA	TUBERCLED ORCHID	1969-08-17
Massac	PLETHOBASUS COOPERIANUS	ORANGE-FOOT PIMPLEBACK	1998
Massac	PLETHOBASUS CYPHYUS	SHEEPNOSE MUSSEL	1987-07
Massac	PLETHOBASUS CYPHYUS	SHEEPNOSE MUSSEL	1998-09-30
Massac	PLETHOBASUS CYPHYUS	SHEEPNOSE MUSSEL	1998
Massac	PLEUROBEMA CORDATUM	OHIO PIGTOE	1998-09-30
Massac	PLEUROBEMA CORDATUM	OHIO PIGTOE	1994-08-17
Massac	PLEUROBEMA CORDATUM	OHIO PIGTOE	1996-09
Massac	PLEUROBEMA RUBRUM	PYRAMID PIGTOE	1998-09-30
Massac	PLEUROBEMA RUBRUM	PYRAMID PIGTOE	1996-09
Massac	POTAMILUS CAPAX	FAT POCKETBOOK PEARLY MUSSEL	1998-08-30
Massac	PSEUDEMYS CONCINNA	RIVER COOTER	1998-08-29
Massac	QUADRULA CYLINDRICA	RABBITSFOOT MUSSEL	1998-12-04
Massac	QUADRULA CYLINDRICA	RABBITSFOOT MUSSEL	1998-09-30
Massac	QUERCUS PHELLOS	WILLOW OAK	1987
Massac	QUERCUS PHELLOS	WILLOW OAK	1986-09-09
Massac	QUERCUS PHELLOS	WILLOW OAK	1987
Massac	QUERCUS PHELLOS	WILLOW OAK	1986-10-31
Massac	QUERCUS PHELLOS	WILLOW OAK	1966-05
Massac	QUERCUS PHELLOS	WILLOW OAK	1990

Massac	STERNA ANTILLARUM	LEAST TERN	1996-06-11
Massac	STYRAX AMERICANA	STORAX	1987
Massac	STYRAX AMERICANA	STORAX	1987
Massac	STYRAX AMERICANA	STORAX	1986
Massac	STYRAX AMERICANA	STORAX	1986
Massac	STYRAX AMERICANA	STORAX	1986
Massac	THAMNOPHIS SAURITUS	EASTERN RIBBON SNAKE	1991-04-25
Massac	TILIA HETEROPHYLLA	WHITE BASSWOOD	1987
McCracken KY	CYCLONAIAS TUBERCULATA	PURPLE WARTYBACK	1998-12-04
McCracken KY	ELLIPSARIA LINEOLATA	BUTTERFLY	1998-09-03
McCracken KY	ELLIPTIO CRASSIDENS	ELEPHANT-EAR MUSSEL	1997-10-27
McCracken KY	FUSCONAIA EBENA	EBONYSHELL	1998-09-03
McCracken KY	LIGUMIA RECTA	BLACK SANDSHELL	1998-12-04
McCracken KY	LIGUMIA RECTA	BLACK SANDSHELL	1998-09-03
McCracken KY	PANDION HALIAETUS	OSPREY	1998-05-25
McCracken KY	PLETHOBASUS COOPERIANUS	ORANGE-FOOT PIMPLEBACK	1998
McCracken KY	PLETHOBASUS CYPHYUS	SHEEPNOSE MUSSEL	1998
McCracken KY	PSEUDEMYS CONCINNA	RIVER COOTER	1998-08-29
Pope	AMMODRAMUS HENSLOWII	HENSLOW'S SPARROW	1993-06-07
Pope	AMORPHA NITENS	SMOOTH FALSE INDIGO	1996
Pope	ARISTOLOCHIA SERPENTARIA VAR HASTATA	NARROW-LEAVED SNAKEROOT	1986-09-17
Pope	BARTONIA PANICULATA	SCREWSTEM	1994
Pope	BARTONIA PANICULATA	SCREWSTEM	1994
Pope	BARTONIA PANICULATA	SCREWSTEM	1995-11-02
Pope	BERCHEMIA SCANDENS	SUPPLE-JACK	1992-11-13
Pope	BOTRYCHIUM BITERNATUM	SOUTHERN GRAPE FERN	1982
Pope	BOTRYCHIUM BITERNATUM	SOUTHERN GRAPE FERN	1994-12-03
Pope	BOTRYCHIUM BITERNATUM	SOUTHERN GRAPE FERN	1994
Pope	BUTEO LINEATUS	RED-SHOULDERED HAWK	1989-05
Pope	CALAMAGROSTIS INSPERATA	BLUEJOINT GRASS	1993-03-15
Pope	CALAMAGROSTIS INSPERATA	BLUEJOINT GRASS	1993-06-07
Pope	CAREX ALATA	WINGED SEDGE	1987

Pope	CAREX COMMUNIS	FIBROUS-ROOTED SEDGE	1984-06-15
Pope	CAREX INTUMESCENS	SWOLLEN SEDGE	1994-07-12
Pope	CAREX INTUMESCENS	SWOLLEN SEDGE	1993-08-18
Pope	CAREX PRASINA	DROOPING SEDGE	1997-05-14
Pope	CAREX WILLDENOWII	WILLDENOW'S SEDGE	1994-08-11
Pope	CAREX WILLDENOWII	WILLDENOW'S SEDGE	1993-07-03
Pope	CAREX WILLDENOWII	WILLDENOW'S SEDGE	1994-07-14
Pope	CAREX WILLDENOWII	WILLDENOW'S SEDGE	1997-05-14
Pope	CAREX WILLDENOWII	WILLDENOW'S SEDGE	1997-05-14
Pope	CAREX WILLDENOWII	WILLDENOW'S SEDGE	1997-06-25
Pope	CHIMAPHILA MACULATA	SPOTTED WINTERGREEN	
Pope	CHIMAPHILA MACULATA	SPOTTED WINTERGREEN	1993-10-03
Pope	CIMICIFUGA RUBIFOLIA	BLACK COHOSH	1993
Pope	CIMICIFUGA RUBIFOLIA	BLACK COHOSH	1994-09-09
Pope	CIMICIFUGA RUBIFOLIA	BLACK COHOSH	1999-04-21
Pope	CIRCUS CYANEUS	NORTHERN HARRIER	1995-02-28
Pope	CORYDALIS HALEI	HALE'S CORYDALIS	1986-05-03
Pope	CRANGONYX ANOMALUS	AMPHIPOD	1974-11-06
Pope	CRANGONYX ANOMALUS	AMPHIPOD	1992-04-15
Pope	CROTALUS HORRIDUS	TIMBER RATTLESNAKE	1990'S
Pope	CROTALUS HORRIDUS	TIMBER RATTLESNAKE	199O'S
Pope	CROTALUS HORRIDUS	TIMBER RATTLESNAKE	1992-04
Pope	CROTALUS HORRIDUS	TIMBER RATTLESNAKE	1990-05-18
Pope	DENNSTAEDTIA PUNCTILOBULA	HAY-SCENTED FERN	1994
Pope	DENNSTAEDTIA PUNCTILOBULA	HAY-SCENTED FERN	1987
Pope	DENNSTAEDTIA PUNCTILOBULA	HAY-SCENTED FERN	1989-05-02
Pope	DENNSTAEDTIA PUNCTILOBULA	HAY-SCENTED FERN	1977
Pope	DENNSTAEDTIA PUNCTILOBULA	HAY-SCENTED FERN	1970
Pope	DENNSTAEDTIA PUNCTILOBULA	HAY-SCENTED FERN	
Pope	ERYNGIUM PROSTRATUM	ERYNGO	1996
Pope	EUONYMUS AMERICANUS	STRAWBERRY BUSH	1997-09-30
Pope	EUPATORIUM INCARNATUM	THOROUGHWORT	1994-10

Pope	FUSCONAIA EBENA	EBONYSHELL	1994
Pope	FUSCONAIA EBENA	EBONYSHELL	1994
Pope	HALIAEETUS LEUCOCEPHALUS	BALD EAGLE	1989-03-02
Pope	HALIAEETUS LEUCOCEPHALUS	BALD EAGLE	1993
Pope	HALIAEETUS LEUCOCEPHALUS	BALD EAGLE	1998-05
Pope	HALIAEETUS LEUCOCEPHALUS	BALD EAGLE	1998-02
Pope	HALIAEETUS LEUCOCEPHALUS	BALD EAGLE	1997-04-17
Pope	HELIANTHUS ANGUSTIFOLIUS	NARROW-LEAVED SUNFLOWER	1986
Pope	HELIANTHUS ANGUSTIFOLIUS	NARROW-LEAVED SUNFLOWER	1996
Pope	HELIANTHUS ANGUSTIFOLIUS	NARROW-LEAVED SUNFLOWER	1987
Pope	HELIANTHUS ANGUSTIFOLIUS	NARROW-LEAVED SUNFLOWER	1996
Pope	HESPERIA METEA	COBWEB SKIPPER	1986-04-29
Pope	HESPERIA METEA	COBWEB SKIPPER	1989-05-16
Pope	HETERANTHERA RENIFORMIS	MUD PLANTAIN	1990-07-25
Pope	HYLA AVIVOCA	BIRD-VOICED TREEFROG	1996-06
Pope	HYLA AVIVOCA	BIRD-VOICED TREEFROG	1998-09-26
Pope	ISOTRIA VERTICILLATA	WHORLED POGONIA	1997-04
Pope	ISOTRIA VERTICILLATA	WHORLED POGONIA	1987
Pope	ISOTRIA VERTICILLATA	WHORLED POGONIA	1987
Pope	LACTUCA HIRSUTA	WILD LETTUCE	1996
Pope	LACTUCA HIRSUTA	WILD LETTUCE	1970
Pope	LACTUCA HIRSUTA	WILD LETTUCE	1993-08-25
Pope	LACTUCA HIRSUTA	WILD LETTUCE	1993-07-18
Pope	LACTUCA HIRSUTA	WILD LETTUCE	1993-09-20
Pope	LAMPETRA AEPYPTERA	LEAST BROOK LAMPREY	1998
Pope	LAMPETRA AEPYPTERA	LEAST BROOK LAMPREY	1997
Pope	LAMPETRA AEPYPTERA	LEAST BROOK LAMPREY	1998
Pope	LANIUS LUDOVICIANUS	LOGGERHEAD SHRIKE	1989-04-19
Pope	LANIUS LUDOVICIANUS	LOGGERHEAD SHRIKE	1989
Pope	LONICERA FLAVA	YELLOW HONEYSUCKLE	1992-08-31
Pope	LONICERA FLAVA	YELLOW HONEYSUCKLE	
Pope	LONTRA CANADENSIS	RIVER OTTER	1991-12

Pope	LONTRA CANADENSIS	RIVER OTTER	1982-11-19
Pope	LONTRA CANADENSIS	RIVER OTTER	1987-10-15
Pope	LYSIMACHIA FRASERI	LOOSESTRIFE	1992-07-15
Pope	MALUS ANGUSTIFOLIA	NARROW-LEAVED CRABAPPLE	1987
Pope	MATELEA OBLIQUA	CLIMBING MILKWEED	1996
Pope	MATELEA OBLIQUA	CLIMBING MILKWEED	1991-06-18
Pope	MATELEA OBLIQUA	CLIMBING MILKWEED	1990-06
Pope	MATELEA OBLIQUA	CLIMBING MILKWEED	1991-07-25
Pope	MATELEA OBLIQUA	CLIMBING MILKWEED	1994-09-27
Pope	MELOTHRIA PENDULA	SQUIRTING CUCUMBER	1982-07-10
Pope	MELOTHRIA PENDULA	SQUIRTING CUCUMBER	1953-08-21
Pope	MELOTHRIA PENDULA	SQUIRTING CUCUMBER	1998-07-31
Pope	MYOTIS AUSTRORIPARIUS	SOUTHEASTERN BAT	1997-07-28
Pope	MYOTIS AUSTRORIPARIUS	SOUTHEASTERN BAT	1993-10-23
Pope	MYOTIS AUSTRORIPARIUS	SOUTHEASTERN BAT	1993-04-17
Pope	MYOTIS GRISESCENS	GRAY BAT	1991-06-26
Pope	MYOTIS SODALIS	INDIANA BAT	1992-04-05
Pope	MYOTIS SODALIS	INDIANA BAT	1993-10-23
Pope	MYOTIS SODALIS	INDIANA BAT	1993-04-17
Pope	MYOTIS SODALIS	INDIANA BAT	1989
Pope	NERODIA ERYTHROGASTER NEGLECTA	COPPERBELLY WATER SNAKE	1994-04-17
Pope	NERODIA ERYTHROGASTER NEGLECTA	COPPERBELLY WATER SNAKE	1988-05-13
Pope	NERODIA ERYTHROGASTER NEGLECTA	COPPERBELLY WATER SNAKE	1982-05
Pope	OCHROTOMYS NUTTALLI	GOLDEN MOUSE	1985-06-12
Pope	OCHROTOMYS NUTTALLI	GOLDEN MOUSE	1971-10-17
Pope	OCHROTOMYS NUTTALLI	GOLDEN MOUSE	1988-06-21
Pope	OCHROTOMYS NUTTALLI	GOLDEN MOUSE	1988-11-29
Pope	OCHROTOMYS NUTTALLI	GOLDEN MOUSE	1992-01-03
Pope	OCHROTOMYS NUTTALLI	GOLDEN MOUSE	1997-02-15
Pope	OCHROTOMYS NUTTALLI	GOLDEN MOUSE	1995-02-14
Pope	OCHROTOMYS NUTTALLI	GOLDEN MOUSE	1995-03-31
Pope	ORCONECTES INDIANENSIS	CRAYFISH	1973-05-19

Pope	ORCONECTES INDIANENSIS	CRAYFISH	1997-07-19
Pope	ORYZOMYS PALUSTRIS	MARSH RICE RAT	1986-06-03
Pope	OXALIS ILLINOENSIS	ILLINOIS WOOD SORREL	1968
Pope	OXALIS ILLINOENSIS	ILLINOIS WOOD SORREL	1968
Pope	OXALIS ILLINOENSIS	ILLINOIS WOOD SORREL	1986
Pope	OXALIS ILLINOENSIS	ILLINOIS WOOD SORREL	1988-05-13
Pope	OXALIS ILLINOENSIS	ILLINOIS WOOD SORREL	1968
Pope	PANICUM YADKINENSE	PANIC GRASS	1986-09-25
Pope	PANICUM YADKINENSE	PANIC GRASS	1987
Pope	PANICUM YADKINENSE	PANIC GRASS	1997-06-30
Pope	PANICUM YADKINENSE	PANIC GRASS	1997-06-25
Pope	PENSTEMON BREVISEPALUS	SHORT-SEPALED BEARDSTONGUE	1981-05-07
Pope	PLANERA AQUATICA	WATER ELM	1988-09-13
Pope	PLANTAGO CORDATA	HEART-LEAVED PLANTAIN	1989-08-02
Pope	PLATANTHERA CLAVELLATA	WOOD ORCHID	1988-05-13
Pope	PLATANTHERA CLAVELLATA	WOOD ORCHID	1970
Pope	POA ALSODES	WOODLAND BLUEGRASS	1986-09-25
Pope	POLYGALA INCARNATA	PINK MILKWORT	1984
Pope	POLYGALA INCARNATA	PINK MILKWORT	1996
Pope	POLYGALA INCARNATA	PINK MILKWORT	1996
Pope	PYCNANTHEMUM TORREI	MOUNTAIN MINT	1987
Pope	RHYNCHOSPORA GLOMERATA	CLUSTERED BEAKED RUSH	1992-07-31
Pope	SAGITTARIA LONGIROSTRA	ARROWLEAF	1987
Pope	SALVIA AZUREA SSP PITCHERI	BLUE SAGE	1996
Pope	SALVIA AZUREA SSP PITCHERI	BLUE SAGE	1988-09-19
Pope	SALVIA AZUREA SSP PITCHERI	BLUE SAGE	
Pope	SCIRPUS POLYPHYLLUS	LEAFY BULRUSH	1996
Pope	SCIRPUS POLYPHYLLUS	LEAFY BULRUSH	1994
Pope	SCIRPUS POLYPHYLLUS	LEAFY BULRUSH	1987
Pope	SCIRPUS POLYPHYLLUS	LEAFY BULRUSH	1987
Pope	SPIRANTHES VERNALIS	LADIES' TRESSES	1987-07
Pope	SPIRANTHES VERNALIS	LADIES' TRESSES	1994

Pope	STELLARIA PUBERA	GREAT CHICKWEED	1988-05-12
Pope	STELLARIA PUBERA	GREAT CHICKWEED	1993-04-28
Pope	STELLARIA PUBERA	GREAT CHICKWEED	1994-08-17
Pope	STENANTHIUM GRAMINEUM	GRASS-LEAVED LILY	1987-06
Pope	STYRAX AMERICANA	STORAX	1988
Pope	STYRAX AMERICANA	STORAX	1988-09-13
Pope	THAMNOPHIS SAURITUS	EASTERN RIBBON SNAKE	1989-06-17
Pope	THELYPTERIS NOVEBORACENSIS	NEW YORK FERN	1982
Pope	THRYOMANES BEWICKII	BEWICK'S WREN	1990-07-13
Pope	THRYOMANES BEWICKII	BEWICK'S WREN	1973-06-21
Pope	TOXOLASMA LIVIDUS	PURPLE LILLIPUT MUSSEL	1997-05-14
Pope	TRICHOMANES BOSCHIANUM	FILMY FERN	1999-01-26
Pope	TRICHOMANES BOSCHIANUM	FILMY FERN	1999-02-22
Pope	WALDSTEINIA FRAGARIOIDES	BARREN STRAWBERRY	1987

268 Records Processed

APPENDIX B Hazardous Toxic and Radiological Wastes

The EDR-Radius Map
with GeoCheck®

IL-10
Big Bay Creek and
Barren Creek
Habitat Restoration
Ohio River Mile 910-910.7

Inquiry Number: 379722.1s

June 14, 1999

Environmental Data Resources, Inc.
an edr company

The Source
For Environmental
Risk Management
Data

3530 Post Road
Southport, Connecticut 06490

Nationwide Customer Service

Telephone: 1-800-352-0050
Fax: 1-800-231-6802
Internet: www.edrnet.com

TABLE OF CONTENTS

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

EXECUTIVE SUMMARY

A search of available environmental records was conducted by Environmental Data Resources, Inc. (EDR). The report meets the government records search requirements of ASTM Standard Practice for Environmental Site Assessments, E 1527-97. Search distances are per ASTM standard or custom distances requested by the user.

The address of the subject property for which the search was intended is:

IL-10, RIVER MILE 9-10
GOLCONDA, IL 62938

No mapped sites were found in EDR's search of available (*reasonably ascertainable ") government records either on the subject property or within the ASTM E 1527-97 search radius around the subject property for the following Databases:

NPL:	National Priority List
Delisted NPL:	NPL Deletions
RCRIS-TSD:	Resource Conservation and Recovery Information System
SHWS:	State Haz. Waste
CERCLIS:	Comprehensive Environmental Response, Compensation, and Liability Information System
CERC-NFRAP:	Comprehensive Environmental Response, Compensation, and Liability Information System
CORRACTS:	Corrective Action Report
SWF/LF:	Available Disposal for Solid Wast in Illinois- Solid Waste Landfills Subject to State Surcharge
LUST:	Leaking Underground Storage Tank Sites
UST:	STC (State, Town, County) Facility List
RAATS:	RCRA Administrative Action Tracking System
RCRIS-SQG:	Resource Conservation and Recovery Information System
RCRIS-LQG:	Resource Conservation and Recovery Information System
HMIRS:	Hazardous Materials Information Reporting System
PADS:	PCB Activity Database System
ERNS:	Emergency Response Notification System
FINDS:	Facility Index System/Facility Identification Initiative Program Summary Report
TRIS:	Toxic Chemical Release Inventory System
NPL Lien:	NPL Liens
TSCA:	Toxic Substances Control Act
MLTS:	Material Licensing Tracking System
Plan Comm:	Illinois Planning Comm.
CAT:	Category List
ROD:	ROD
CONSENT:	Superfund (CERCLA) Consent Decrees
Coal Gas:	Former Manufactured gas (Coal Gas) Sites.
MINES:	Mines Master Index File

Unmapped (orphan) sites are not considered in the foregoing analysis.

Search Results:

Search results for the subject property and the search radius, are listed below:

Subject Property:

The subject property was not listed in any of the databases searched by EDR.

EXECUTIVE SUMMARY

Due to poor or inadequate address information, the following sites were not mapped:

Site Name	Database(s)
FRUITBELT SERVICE CO.	LUST
LIVINGSTON CO MIDDLE SCHOOL	UST
BURNA BP	UST
DAVIS REPAIR	UST
GEE JAYS FOOD MART	UST
HWY 146	UST
HWY 146	UST
HWY 146	UST
1/2 MI WEST ST RT 146	UST
BROWN'S SERVICE STATION	RCRIS-SQG,FINDS
OHIO RIVER	ERNS
OHIO RIVER MM 901 RIGHT DECENDING BANK	ERNS

TOPOGRAPHIC MAP - 379722.1s - Parsons Engineering Science

- Major Roads
- Contour Lines
- Waterways
- Earthquake epicenter, Richter 5 or greater
- Closest Federal Well in quadrant
- Closest State Well in quadrant
- Closest Public Water Supply Well

Closest Hydrogeological Data

TARGET PROPERTY:	IL-10, River Mile 9-10	CUSTOMER:	Parsons Engineering Science
ADDRESS:	IL-10, River Mile 9-10	CONTACT:	Mr. Bruce Cox
CITY/STATE/ZIP:	Golconda IL 62938	INQUIRY #:	379722.1s
LAT/LONG:	37.2540 / 88.5031	DATE:	June 14, 1999 9:06 am

GEOCHECK VERSION 2.1
SUMMARY

TARGET PROPERTY COORDINATES

Latitude (North):	37.254002 - 37° 15' 14.4"
Longitude (West):	88.503098 - 88° 30' 11.2"
Universal Transverse Mercator:	Zone 16
UTM X (Meters):	366696.8
UTM Y (Meters):	4123904.8

USGS TOPOGRAPHIC MAP ASSOCIATED WITH THIS SITE

Target Property:	2437088-C5 BROWNFIELD, IL KY

GEOLOGIC AGE IDENTIFICATION†

Geologic Code:	M2
Era:	Paleozoic
System:	Mississippian
Series:	Meramecian Series

ROCK STRATIGRAPHIC UNIT†

Category:	Stratified Sequence

GROUNDWATER FLOW INFORMATION

Groundwater flow direction for a particular site is best determined by a qualified environmental professional using site-specific well data. If such data is not reasonably ascertainable, it may be necessary to rely on other sources of information, including well data collected on nearby properties, regional groundwater flow information (from deep aquifers), or surface topography.‡

AQUIFLOW™** Search Radius: 2.000 Miles

MAP ID	DISTANCE FROM TP	DIRECTION FROM TP	GENERAL DIRECTION GROUNDWATER FLOW
Not Reported			

General Topographic Gradient at Target Property: General NNE
General Hydrogeologic Gradient at Target Property: No hydrogeologic data available.
Site-Specific Hydrogeological Data*:

Search Radius:	2.0 miles
Status:	Not found

FEDERAL DATABASE WELL INFORMATION

WELL QUADRANT	DISTANCE FROM TP	LITHOLOGY	DEPTH TO WATER TABLE
NO WELLS FOUND			

STATE DATABASE WELL INFORMATION

WELL QUADRANT	DISTANCE FROM TP	DEPTH (FEET)	SOURCE
Southern	1/4 - 1/2 Mile	Not Reported	IL Geological Survey
Western	1 - 2 Miles	Not Reported	IL Geological Survey

† Stauffer, P.G., Schnoebelen, R.E., Arndt and W.J. Stewart, Geology of the Conterminous U.S. at 1:2,500,000 Scale - A digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).
‡ U.S. EPA Ground Water Handbook, Vol I: Ground Water and Contamination, Office of Research and development EPA/625/6-90/016a,Chapter 4, page 78, September 1990.
** EDR AQUIFLOW™ information System of hydrogeologically determined groundwater flow directions at specific locations. See the data pages at the end of this report for a complete description.

GEOCHECK VERSION 2.1
SUMMARY

PUBLIC WATER SUPPLY SYSTEM INFORMATION

Searched by Nearest PWS.
NOTE: PWS System location is not always the same as well location.

PWS Name: GOLCONDA
GOLCONDA, IL 62938
Location Relative to TP: >2 Miles North
PWS currently has or has had major violation(s) or enforcement: Yes

AREA RADON INFORMATION

EPA Radon Zone for POPE County: 2

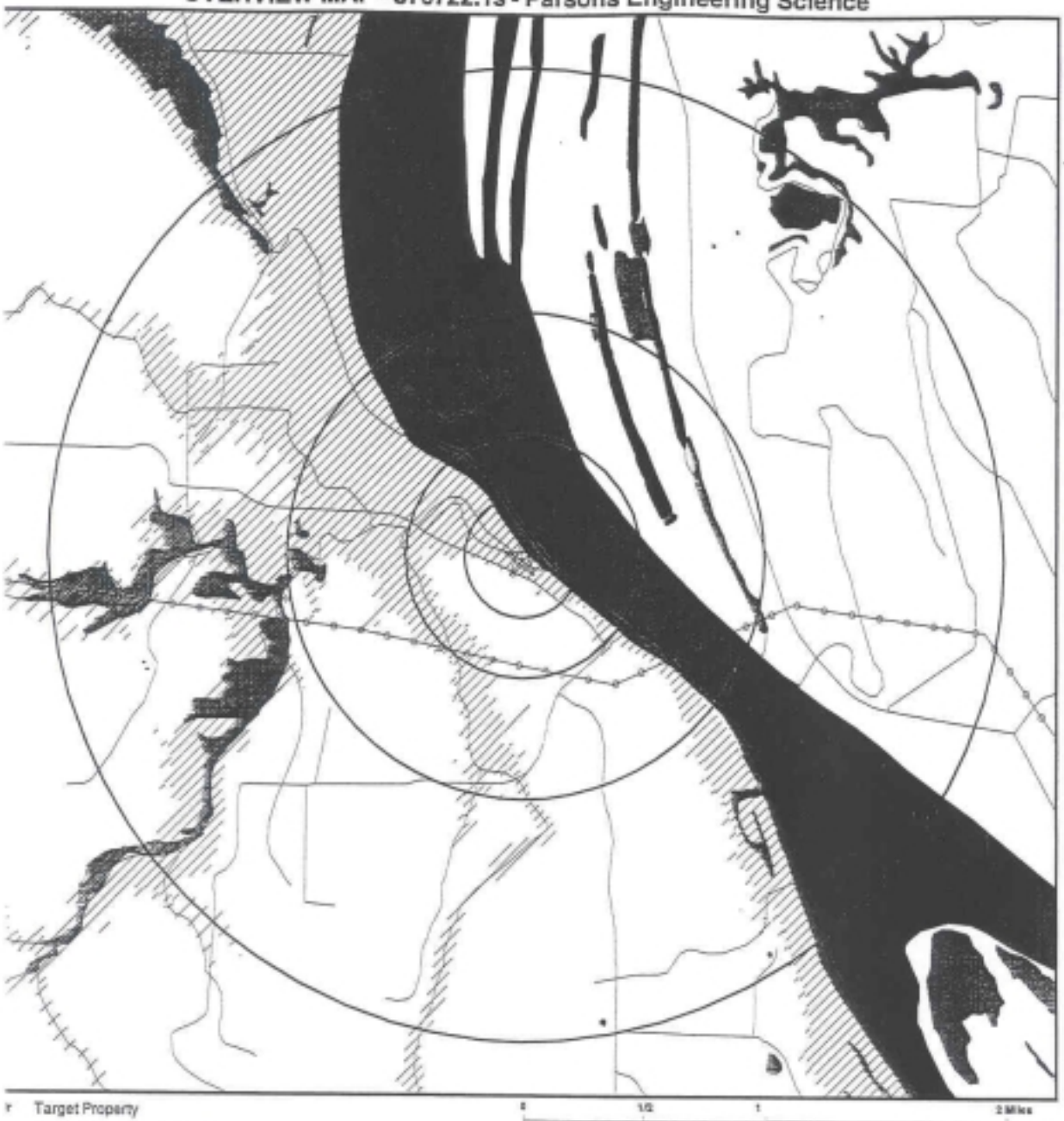
Note: Zone 1 indoor average level > 4 pCi/L.
: Zone 2 indoor average level >= 2 pCi/L and <= 4 pCi/L.
: Zone 3 indoor average level < 2 pCi/L.

POPE COUNTY, IL

Number of sites tested: 1

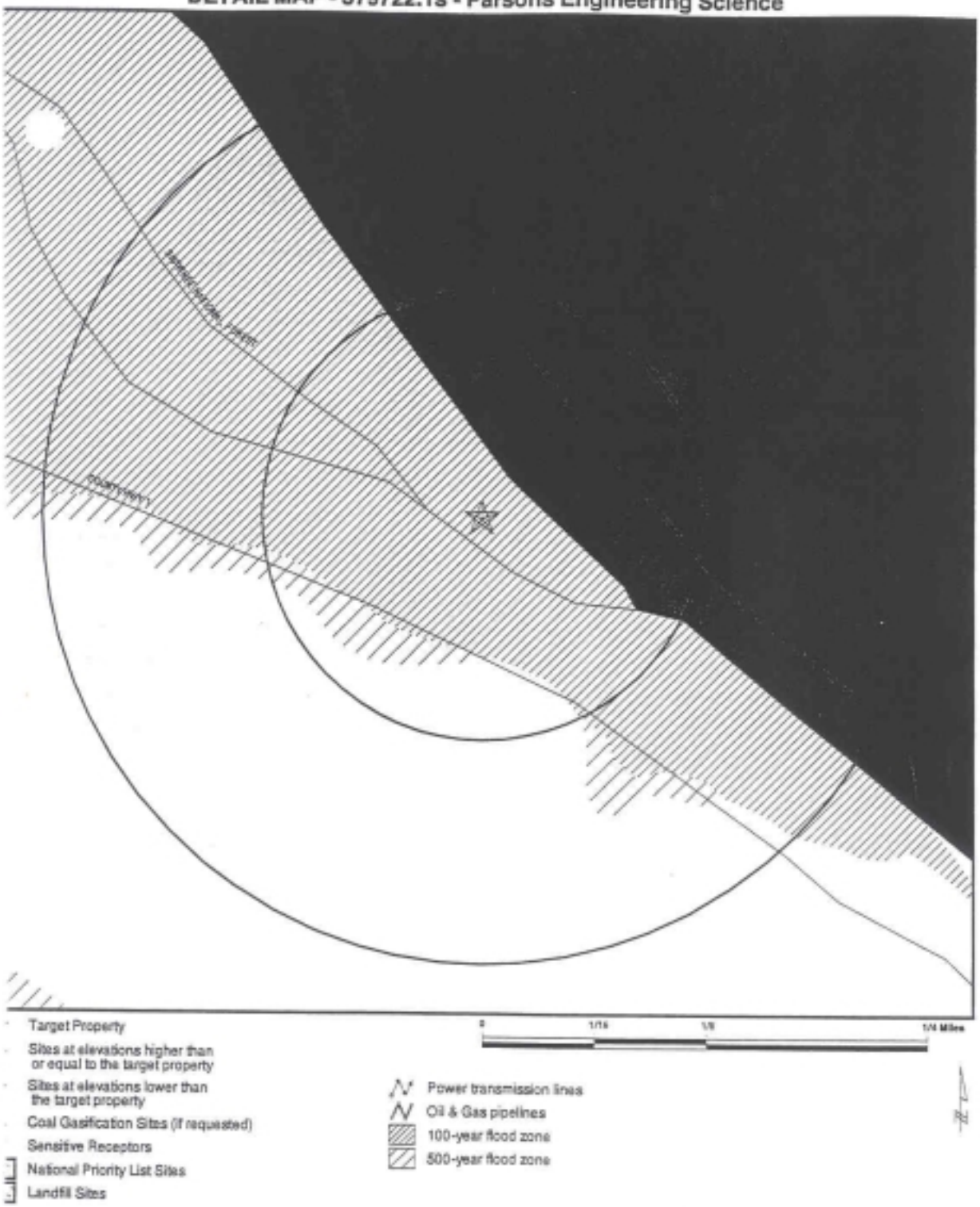
Area	Average Activity	% <4 pCi/L	% 4-20 pCi/L	% >20 pCi/L
Living Area - 1st Floor	0.500 pCi/L	100%	0%	0%
Living Area - 2nd Floor	Not Reported	Not Reported	Not Reported	Not Reported
Basement	Not Reported	Not Reported	Not Reported	Not Reported

OVERVIEW MAP - 379722.1s - Parsons Engineering Science



TARGET PROPERTY:	IL-10, River Mile 9-10	CUSTOMER:	Parsons Engineering Science
ADDRESS:	IL-10, River Mile 9-10	CONTACT:	Mr. Bruce Cox
CITY/STATE/ZIP:	Golconda IL 62938	INQUIRY #:	379722.1s
LAT/LONG:	37.2540 / 88.5031	DATE:	June 14, 1999 9:03 am

DETAIL MAP - 379722.1s - Parsons Engineering Science



TARGET PROPERTY:	IL-10, River Mile 9-10	CUSTOMER:	Parsons Engineering Science
ADDRESS:	IL-10, River Mile 9-10	CONTACT:	Mr. Bruce Cox
CITY/STATE/ZIP:	Golconda IL 62938	INQUIRY #:	379722.1s
LAT/LONG:	37.2540 / 88.5031	DATE:	June 14, 1999 9:05 am

MAP FINDINGS SUMMARY SHOWING ALL SITES

Database	Target Property	Search Distance (Miles)	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
NPL		1.500	0	0	0	0	0	0
Delisted NPL		TP	NR	NR	NR	NR	NR	0
RCRIS-TSD		1.000	0	0	0	0	NR	0
State Haz. Waste		1.500	0	0	0	0	0	0
CERCLIS		1.000	0	0	0	0	NR	0
CERC-NFRAP		TP	NR	NR	NR	NR	NR	0
CORRACTS		1.500	0	0	0	0	0	0
State Landfill		1.000	0	0	0	0	NR	0
LUST		1.000	0	0	0	0	NR	0
UST		0.750	0	0	0	0	NR	0
RAATS		TP	NR	NR	NR	NR	NR	0
RCRIS Sm. Quan. Gen.		0.750	0	0	0	0	NR	0
RCRIS Lg. Quan. Gen.		0.750	0	0	0	0	NR	0
HMIRS		TP	NR	NR	NR	NR	NR	0
PADS		TP	NR	NR	NR	NR	NR	0
ERNS		TP	NR	NR	NR	NR	NR	0
FINDS		TP	NR	NR	NR	NR	NR	0
TRIS		TP	NR	NR	NR	NR	NR	0
NPL Liens		TP	NR	NR	NR	NR	NR	0
TSCA		TP	NR	NR	NR	NR	NR	0
MLTS		TP	NR	NR	NR	NR	NR	0
Illinois Planning Comm.		1.000	0	0	0	0	NR	0
CAT		TP	NR	NR	NR	NR	NR	0
ROD		1.500	0	0	0	0	0	0
CONSENT		1.500	0	0	0	0	0	0
Coal Gas		1.500	0	0	0	0	0	0
MINES		0.750	0	0	0	0	NR	0

TP = Target Property

NR = Not Requested at this Search Distance

* Sites may be listed in more than one database

MAP FINDINGS SUMMARY SHOWING ONLY SITES HIGHER THAN OR THE SAME ELEVATION AS TP

Database	Target Property	Search Distance (Miles)	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
NPL		1.500	0	0	0	0	0	0
Delisted NPL		TP	NR	NR	NR	NR	NR	0
RCRIS-TSD		1.000	0	0	0	0	NR	0
State Haz. Waste		1.500	0	0	0	0	0	0
CERCLIS		1.000	0	0	0	0	NR	0
CERC-NFRAP		TP	NR	NR	NR	NR	NR	0
CORRACTS		1.500	0	0	0	0	0	0
State Landfill		1.000	0	0	0	0	NR	0
LUST		1.000	0	0	0	0	NR	0
UST		0.750	0	0	0	0	NR	0
RAATS		TP	NR	NR	NR	NR	NR	0
RCRIS Sm. Quan. Gen.		0.750	0	0	0	0	NR	0
RCRIS Lg. Quan. Gen.		0.750	0	0	0	0	NR	0
HMIRS		TP	NR	NR	NR	NR	NR	0
PADS		TP	NR	NR	NR	NR	NR	0
ERNS		TP	NR	NR	NR	NR	NR	0
FINDS		TP	NR	NR	NR	NR	NR	0
TRIS		TP	NR	NR	NR	NR	NR	0
NPL Liens		TP	NR	NR	NR	NR	NR	0
TSCA		TP	NR	NR	NR	NR	NR	0
MLTS		TP	NR	NR	NR	NR	NR	0
Illinois Planning Comm.		1.000	0	0	0	0	NR	0
CAT		TP	NR	NR	NR	NR	NR	0
ROD		1.500	0	0	0	0	0	0
CONSENT		1.500	0	0	0	0	0	0
Coal Gas		1.500	0	0	0	0	0	0
MINES		0.750	0	0	0	0	NR	0

TP = Target Property

NR = Not Requested at this Search Distance

* Sites may be listed in more than one database

Map ID
Direction
Distance
Distance (ft.)
Elevation Site

MAP FINDINGS

Database(s) EDR ID Number EPA ID Number

Coal Gas Site Search: No site was found in a search of Real Property Scan's ENVIROHAZ database.

NO SITES FOUND

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City	EDR ID	Site Name	Site Address	Zip	Database(s)	Facility ID
BURNA	1000518189	BROWN'S SERVICE STATION	HIGHWAY 60	42028	RCRIS-SQG, FINDS	
BURNA	U001182336	LIVINGSTON CO MIDDLE SCHOOL	1370 HWY 60 E	42028	UST	
BURNA	U001182422	BURNA BP	HWY 60	42028	UST	
BURNA	U003180571	DAVIS REPAIR	1639 HWY 60 E	42028	UST	
BURNA	U003415752	GEE JAYS FOOD MART	1463 US HIGHWAY 60 E	42028	UST	
GOLCONDA	U003309737		HWY 146	62938	UST	7-001928
GOLCONDA	U003310026		HWY 146	62938	UST	7-011528
GOLCONDA	U003310110		HWY 146	62938	UST	7-014029
GOLCONDA	S103694328	FRUITBELT SERVICE CO.	HWY 146 WEST		LUST	
GOLCONDA	93321364	OHIO RIVER	OHIO RIVER		ERNS	
GOLCONDA	98455957	OHIO RIVER MM 901 RIGHT DECENDING BANK	OHIO RIVER MM 901 RIGHT DECENDING BANK		ERNS	
GOLCONDA	U003310576		1/2 MI WEST ST RT 146	62938	UST	7-029015

GEOCHECK VERSION 2.1 ADDENDUM
STATE DATABASE WELL INFORMATION

Water Wells Information:

Well Within 1/4 - 1/2 Mile of Target Property (Southern Quadrant)

Info Source:	IL Geological Survey		
API ID:	121510027700	Group Number:	31
Well Type:	WATER	Boring:	0
X Coord:	3289906	Y Coord:	1543627

Well Within 1 - 2 Miles of Target Property (Western Quadrant)

Info Source:	IL Geological Survey		
API ID:	121512044600	Group Number:	31
Well Type:	WATER	Boring:	0
X Coord:	3282221	Y Coord:	1550463

GEOCHECK VERSION 2.1
PUBLIC WATER SUPPLY SYSTEM INFORMATION

Searched by Nearest PWS.

PWS SUMMARY:

PWS ID:	IL1510100	PWS Status:	Active	Distance from TP:	>2 Miles
Date Initiated:	January / 1935	Date Deactivated:	Not Reported	Dir relative to TP:	North
PWS Name:	GOLCONDA GOLCONDA, IL 62938				
Addressee / Facility:	Not Reported				
Facility Latitude:	37 22 04		Facility Longitude:	088 28 54	
City Served:	GOLCONDA				
Treatment Class:	Treated		Population Served:	501 - 1,000 Persons	
PWS currently has or has had major violation(s) or enforcement:			Yes		

VIOLATIONS INFORMATION:

Violation ID:	9423452	Source ID:	000	PWS Phone:	Not Reported
Vio. beginning Date:	01/01/94	Vio. end Date:	01/31/94	Vio. Period:	1 Month
Num of required Samples:	17	Number of Samples Taken:		8	
Analysis Result:	Not Reported	Maximum Contaminant Level:		Not Reported	
Analysis Method:	Not Reported				
Violation Type:	Monitoring, Routine/Repeat (SWTR-Filter)				
Contaminant:	Not Reported				
Vio. Awareness Date:	Not Reported				

Violation ID:	9423453	Source ID:	000	PWS Phone:	Not Reported
Vio. beginning Date:	02/01/94	Vio. end Date:	02/28/94	Vio. Period:	1 Month
Num of required Samples:	16	Number of Samples Taken:		0	
Analysis Result:	Not Reported	Maximum Contaminant Level:		Not Reported	
Analysis Method:	Not Reported				
Violation Type:	Monitoring, Routine/Repeat (SWTR-Filter)				
Contaminant:	Not Reported				
Vio. Awareness Date:	Not Reported				

Violation ID:	9422297	Source ID:	000	PWS Phone:	Not Reported
Vio. beginning Date:	12/01/93	Vio. end Date:	12/31/93	Vio. Period:	1 Month
Num of required Samples:	16	Number of Samples Taken:		8	
Analysis Result:	Not Reported	Maximum Contaminant Level:		Not Reported	
Analysis Method:	Not Reported				
Violation Type:	Monitoring, Routine/Repeat (SWTR-Filter)				
Contaminant:	Not Reported				
Vio. Awareness Date:	Not Reported				

Violation ID:	9425195	Source ID:	Not Reported	PWS Phone:	Not Reported
Vio. beginning Date:	10/01/93	Vio. end Date:	03/31/94	Vio. Period:	6 Months
Num of required Samples:	Not Reported	Number of Samples Taken:		Not Reported	
Analysis Result:	Not Reported	Maximum Contaminant Level:		Not Reported	
Analysis Method:	Not Reported				
Violation Type:	Initial Tap Sampling for Pb and Cu				
Contaminant:	LEAD & COPPER RULE				
Vio. Awareness Date:	Not Reported				

Violation ID:	9425194	Source ID:	Not Reported	PWS Phone:	Not Reported
Vio. beginning Date:	04/01/94	Vio. end Date:	04/30/94	Vio. Period:	1 Month
Num of required Samples:	Not Reported	Number of Samples Taken:		Not Reported	
Analysis Result:	Not Reported	Maximum Contaminant Level:		Not Reported	
Analysis Method:	Not Reported				
Violation Type:	Monitoring, Routine Major (TCR)				
Contaminant:	COLIFORM (TCR)				
Vio. Awareness Date:	Not Reported				

GEOCHECK VERSION 2.1
PUBLIC WATER SUPPLY SYSTEM INFORMATION

Searched by Nearest PWS.

PWS SUMMARY:

Violation ID:	9325193	Source ID:	000	PWS Phone:	Not Reported
Vio. beginning Date:	07/01/93	Vio. end Date:	06/30/94	Vio. Period:	12 Month
Num of required Samples:	Not Reported	Number of Samples Taken:		0	
Analysis Result:	Not Reported	Maximum Contaminant Level:		Not Reported	
Analysis Method:	Not Reported				
Violation Type:	Monitoring, Regular				
Contaminant:	STYRENE				
Vio. Awareness Date:	Not Reported				

Violation ID:	9325192	Source ID:	000	PWS Phone:	Not Reported
Vio. beginning Date:	07/01/93	Vio. end Date:	06/30/94	Vio. Period:	12 Month
Num of required Samples:	Not Reported	Number of Samples Taken:		0	
Analysis Result:	Not Reported	Maximum Contaminant Level:		Not Reported	
Analysis Method:	Not Reported				
Violation Type:	Monitoring, Regular				
Contaminant:	ETHYLBENZENE				
Vio. Awareness Date:	Not Reported				

Violation ID:	9325191	Source ID:	000	PWS Phone:	Not Reported
Vio. beginning Date:	07/01/93	Vio. end Date:	06/30/94	Vio. Period:	12 Month
Num of required Samples:	Not Reported	Number of Samples Taken:		0	
Analysis Result:	Not Reported	Maximum Contaminant Level:		Not Reported	
Analysis Method:	Not Reported				
Violation Type:	Monitoring, Regular				
Contaminant:	TOLUENE				
Vio. Awareness Date:	Not Reported				

Violation ID:	9325190	Source ID:	000	PWS Phone:	Not Reported
Vio. beginning Date:	07/01/93	Vio. end Date:	06/30/94	Vio. Period:	12 Month
Num of required Samples:	Not Reported	Number of Samples Taken:		0	
Analysis Result:	Not Reported	Maximum Contaminant Level:		Not Reported	
Analysis Method:	Not Reported				
Violation Type:	Monitoring, Regular				
Contaminant:	BENZENE				
Vio. Awareness Date:	Not Reported				

Violation ID:	9325189	Source ID:	000	PWS Phone:	Not Reported
Vio. beginning Date:	07/01/93	Vio. end Date:	06/30/94	Vio. Period:	12 Month
Num of required Samples:	Not Reported	Number of Samples Taken:		0	
Analysis Result:	Not Reported	Maximum Contaminant Level:		Not Reported	
Analysis Method:	Not Reported				
Violation Type:	Monitoring, Regular				
Contaminant:	MONOCHLOROBENZENE (CHLOROBENZENE)				
Vio. Awareness Date:	Not Reported				

Violation ID:	9325188	Source ID:	000	PWS Phone:	Not Reported
Vio. beginning Date:	07/01/93	Vio. end Date:	06/30/94	Vio. Period:	12 Month
Num of required Samples:	Not Reported	Number of Samples Taken:		0	
Analysis Result:	Not Reported	Maximum Contaminant Level:		Not Reported	
Analysis Method:	Not Reported				
Violation Type:	Monitoring, Regular				
Contaminant:	TETRACHLOROETHYLENE				
Vio. Awareness Date:	Not Reported				

GEOCHECK VERSION 2.1
PUBLIC WATER SUPPLY SYSTEM INFORMATION

Searched by Nearest PWS.

PWS SUMMARY:

Violation ID:	9325193	Source ID:	000	PWS Phone:	Not Reported
Vio. beginning Date:	07/01/93	Vio. end Date:	06/30/94	Vio. Period:	12 Month
Num of required Samples:	Not Reported	Number of Samples Taken:		0	
Analysis Result:	Not Reported	Maximum Contaminant Level:		Not Reported	
Analysis Method:	Not Reported				
Violation Type:	Monitoring, Regular				
Contaminant:	STYRENE				
Vio. Awareness Date:	Not Reported				

Violation ID:	9325192	Source ID:	000	PWS Phone:	Not Reported
Vio. beginning Date:	07/01/93	Vio. end Date:	06/30/94	Vio. Period:	12 Month
Num of required Samples:	Not Reported	Number of Samples Taken:		0	
Analysis Result:	Not Reported	Maximum Contaminant Level:		Not Reported	
Analysis Method:	Not Reported				
Violation Type:	Monitoring, Regular				
Contaminant:	ETHYLBENZENE				
Vio. Awareness Date:	Not Reported				

Violation ID:	9325191	Source ID:	000	PWS Phone:	Not Reported
Vio. beginning Date:	07/01/93	Vio. end Date:	06/30/94	Vio. Period:	12 Month
Num of required Samples:	Not Reported	Number of Samples Taken:		0	
Analysis Result:	Not Reported	Maximum Contaminant Level:		Not Reported	
Analysis Method:	Not Reported				
Violation Type:	Monitoring, Regular				
Contaminant:	TOLUENE				
Vio. Awareness Date:	Not Reported				

Violation ID:	9325190	Source ID:	000	PWS Phone:	Not Reported
Vio. beginning Date:	07/01/93	Vio. end Date:	06/30/94	Vio. Period:	12 Month
Num of required Samples:	Not Reported	Number of Samples Taken:		0	
Analysis Result:	Not Reported	Maximum Contaminant Level:		Not Reported	
Analysis Method:	Not Reported				
Violation Type:	Monitoring, Regular				
Contaminant:	BENZENE				
Vio. Awareness Date:	Not Reported				

Violation ID:	9325189	Source ID:	000	PWS Phone:	Not Reported
Vio. beginning Date:	07/01/93	Vio. end Date:	06/30/94	Vio. Period:	12 Month
Num of required Samples:	Not Reported	Number of Samples Taken:		0	
Analysis Result:	Not Reported	Maximum Contaminant Level:		Not Reported	
Analysis Method:	Not Reported				
Violation Type:	Monitoring, Regular				
Contaminant:	MONOCHLOROBENZENE (CHLOROBENZENE)				
Vio. Awareness Date:	Not Reported				

Violation ID:	9325188	Source ID:	000	PWS Phone:	Not Reported
Vio. beginning Date:	07/01/93	Vio. end Date:	06/30/94	Vio. Period:	12 Month
Num of required Samples:	Not Reported	Number of Samples Taken:		0	
Analysis Result:	Not Reported	Maximum Contaminant Level:		Not Reported	
Analysis Method:	Not Reported				
Violation Type:	Monitoring, Regular				
Contaminant:	TETRACHLOROETHYLENE				
Vio. Awareness Date:	Not Reported				

GEOCHECK VERSION 2.1
PUBLIC WATER SUPPLY SYSTEM INFORMATION

Searched by Nearest PWS.

PWS SUMMARY:

Violation ID:	9325187	Source ID:	000	PWS Phone:	Not Reported
Vio. beginning Date:	07/01/93	Vio. end Date:	06/30/94	Vio. Period:	12 Month
Num of required Samples:	Not Reported	Number of Samples Taken:		0	
Analysis Result:	Not Reported	Maximum Contaminant Level:		Not Reported	
Analysis Method:	Not Reported				
Violation Type:	Monitoring, Regular				
Contaminant:	TRICHLOROETHYLENE				
Vio. Awareness Date:	Not Reported				

Violation ID:	9325186	Source ID:	000	PWS Phone:	Not Reported
Vio. beginning Date:	07/01/93	Vio. end Date:	06/30/94	Vio. Period:	12 Month
Num of required Samples:	Not Reported	Number of Samples Taken:		0	
Analysis Result:	Not Reported	Maximum Contaminant Level:		Not Reported	
Analysis Method:	Not Reported				
Violation Type:	Monitoring, Regular				
Contaminant:	1,2-DICHLOROPROPANE				
Vio. Awareness Date:	Not Reported				

Violation ID:	9325185	Source ID:	000	PWS Phone:	Not Reported
Vio. beginning Date:	07/01/93	Vio. end Date:	06/30/94	Vio. Period:	12 Month
Num of required Samples:	Not Reported	Number of Samples Taken:		0	
Analysis Result:	Not Reported	Maximum Contaminant Level:		Not Reported	
Analysis Method:	Not Reported				
Violation Type:	Monitoring, Regular				
Contaminant:	CARBON TETRACHLORIDE				
Vio. Awareness Date:	Not Reported				

Violation ID:	9325184	Source ID:	000	PWS Phone:	Not Reported
Vio. beginning Date:	07/01/93	Vio. end Date:	06/30/94	Vio. Period:	12 Month
Num of required Samples:	Not Reported	Number of Samples Taken:		0	
Analysis Result:	Not Reported	Maximum Contaminant Level:		Not Reported	
Analysis Method:	Not Reported				
Violation Type:	Monitoring, Regular				
Contaminant:	1,1,1-TRICHLOROETHANE				
Vio. Awareness Date:	Not Reported				

Violation ID:	9325183	Source ID:	000	PWS Phone:	Not Reported
Vio. beginning Date:	07/01/93	Vio. end Date:	06/30/94	Vio. Period:	12 Month
Num of required Samples:	Not Reported	Number of Samples Taken:		0	
Analysis Result:	Not Reported	Maximum Contaminant Level:		Not Reported	
Analysis Method:	Not Reported				
Violation Type:	Monitoring, Regular				
Contaminant:	1,2-DICHLOROETHANE				
Vio. Awareness Date:	Not Reported				

Violation ID:	9325182	Source ID:	000	PWS Phone:	Not Reported
Vio. beginning Date:	07/01/93	Vio. end Date:	06/30/94	Vio. Period:	12 Month
Num of required Samples:	Not Reported	Number of Samples Taken:		0	
Analysis Result:	Not Reported	Maximum Contaminant Level:		Not Reported	
Analysis Method:	Not Reported				
Violation Type:	Monitoring, Regular				
Contaminant:	TRANS-1,2-DICHLOROETHYLENE				
Vio. Awareness Date:	Not Reported				

GEOCHECK VERSION 2.1
PUBLIC WATER SUPPLY SYSTEM INFORMATION

Searched by Nearest PWS.

PWS SUMMARY:

Violation ID:	9325181	Source ID:	000	PWS Phone:	Not Reported
Vio. beginning Date:	07/01/93	Vio. end Date:	06/30/94	Vio. Period:	12 Month
Num of required Samples:	Not Reported	Number of Samples Taken:		0	
Analysis Result:	Not Reported	Maximum Contaminant Level:		Not Reported	
Analysis Method:	Not Reported				
Violation Type:	Monitoring, Regular				
Contaminant:	1,1-DICHLOROETHYLENE				
Vio. Awareness Date:	Not Reported				

Violation ID:	9325180	Source ID:	000	PWS Phone:	Not Reported
Vio. beginning Date:	07/01/93	Vio. end Date:	06/30/94	Vio. Period:	12 Month
Num of required Samples:	Not Reported	Number of Samples Taken:		0	
Analysis Result:	Not Reported	Maximum Contaminant Level:		Not Reported	
Analysis Method:	Not Reported				
Violation Type:	Monitoring, Regular				
Contaminant:	P-DICHLOROBENZENE				
Vio. Awareness Date:	Not Reported				

Violation ID:	9325179	Source ID:	000	PWS Phone:	Not Reported
Vio. beginning Date:	07/01/93	Vio. end Date:	06/30/94	Vio. Period:	12 Month
Num of required Samples:	Not Reported	Number of Samples Taken:		0	
Analysis Result:	Not Reported	Maximum Contaminant Level:		Not Reported	
Analysis Method:	Not Reported				
Violation Type:	Monitoring, Regular				
Contaminant:	O-DICHLOROBENZENE				
Vio. Awareness Date:	Not Reported				

Violation ID:	9325178	Source ID:	000	PWS Phone:	Not Reported
Vio. beginning Date:	07/01/93	Vio. end Date:	06/30/94	Vio. Period:	12 Month
Num of required Samples:	Not Reported	Number of Samples Taken:		0	
Analysis Result:	Not Reported	Maximum Contaminant Level:		Not Reported	
Analysis Method:	Not Reported				
Violation Type:	Monitoring, Regular				
Contaminant:	XYLENES, TOTAL				
Vio. Awareness Date:	Not Reported				

Violation ID:	9325177	Source ID:	000	PWS Phone:	Not Reported
Vio. beginning Date:	07/01/93	Vio. end Date:	06/30/94	Vio. Period:	12 Month
Num of required Samples:	Not Reported	Number of Samples Taken:		0	
Analysis Result:	Not Reported	Maximum Contaminant Level:		Not Reported	
Analysis Method:	Not Reported				
Violation Type:	Monitoring, Regular				
Contaminant:	CIS-1,2-DICHLOROETHYLENE				
Vio. Awareness Date:	Not Reported				

Violation ID:	9321648	Source ID:	Not Reported	PWS Phone:	Not Reported
Vio. beginning Date:	04/01/93	Vio. end Date:	09/30/93	Vio. Period:	6 Months
Num of required Samples:	Not Reported	Number of Samples Taken:		Not Reported	
Analysis Result:	Not Reported	Maximum Contaminant Level:		Not Reported	
Analysis Method:	Not Reported				
Violation Type:	Initial Tap Sampling for Pb and Cu				
Contaminant:	LEAD & COPPER RULE				
Vio. Awareness Date:	Not Reported				

GEOCHECK VERSION 2.1
PUBLIC WATER SUPPLY SYSTEM INFORMATION

Searched by Nearest PWS.

PWS SUMMARY:

ENFORCEMENT INFORMATION:

System Name:	GOLCONDA		
Violation Type:	Monitoring, Routine/Repeat (SWTR-Filter)		
Contaminant:	SWTR		
Compliance Period:	1994-01-01 - 1994-01-31	Analytical Value:	00000000.00
Violation ID:	9423452	Enforcement ID:	Not Reported
Enforcement Date:	Not Reported	Enf. Action:	Not Reported
System Name:	GOLCONDA		
Violation Type:	Monitoring, Routine/Repeat (SWTR-Filter)		
Contaminant:	SWTR		
Compliance Period:	1994-02-01 - 1994-02-28	Analytical Value:	00000000.00
Violation ID:	9423453	Enforcement ID:	9428656
Enforcement Date:	1994-03-28	Enf. Action:	State Violation/Reminder Notice
System Name:	GOLCONDA		
Violation Type:	Monitoring, Routine/Repeat (SWTR-Filter)		
Contaminant:	SWTR		
Compliance Period:	1994-02-01 - 1994-02-28	Analytical Value:	00000000.00
Violation ID:	9423453	Enforcement ID:	9428657
Enforcement Date:	1994-03-28	Enf. Action:	State Public Notif Requested
System Name:	GOLCONDA		
Violation Type:	Monitoring, Routine Major (TCR)		
Contaminant:	COLIFORM (TCR)		
Compliance Period:	1994-04-01 - 1994-04-30	Analytical Value:	00000000.00
Violation ID:	9425194	Enforcement ID:	9434079
Enforcement Date:	1994-06-25	Enf. Action:	State Violation/Reminder Notice
System Name:	GOLCONDA		
Violation Type:	Monitoring, Routine Major (TCR)		
Contaminant:	COLIFORM (TCR)		
Compliance Period:	1994-04-01 - 1994-04-30	Analytical Value:	00000000.00
Violation ID:	9425194	Enforcement ID:	9434080
Enforcement Date:	1994-06-25	Enf. Action:	State Public Notif Requested
System Name:	GOLCONDA		
Violation Type:	Follow-up and Routine Tap Sampling		
Contaminant:	LEAD & COPPER RULE		
Compliance Period:	1995-01-01 - 1995-12-31	Analytical Value:	00000000.00
Violation ID:	9536706	Enforcement ID:	9872212
Enforcement Date:	1998-04-09	Enf. Action:	State Compliance Achieved
System Name:	GOLCONDA		
Violation Type:	Monitoring, Routine/Repeat (SWTR-Filter)		
Contaminant:	SWTR		
Compliance Period:	1995-04-01 - 1995-04-30	Analytical Value:	00000000.00
Violation ID:	9530297	Enforcement ID:	9545577
Enforcement Date:	1995-05-26	Enf. Action:	State Violation/Reminder Notice
System Name:	GOLCONDA		
Violation Type:	Monitoring, Routine/Repeat (SWTR-Filter)		
Contaminant:	SWTR		
Compliance Period:	1995-04-01 - 1995-04-30	Analytical Value:	00000000.00
Violation ID:	9530297	Enforcement ID:	9545578
Enforcement Date:	1995-05-26	Enf. Action:	State Public Notif Requested

GEOCHECK VERSION 2.1
PUBLIC WATER SUPPLY SYSTEM INFORMATION

Searched by Nearest PWS.

PWS SUMMARY:

ENFORCEMENT INFORMATION:

System Name:	GOLCONDA		
Violation Type:	Monitoring, Routine/Repeat (SWTR-Filter)		
Contaminant:	SWTR		
Compliance Period:	1995-06-01 - 1995-06-30	Analytical Value:	00000000.00
Violation ID:	9534066	Enforcement ID:	9554480
Enforcement Date:	1995-08-24	Enf. Action:	State Violation/Reminder Notice
System Name:	GOLCONDA		
Violation Type:	Monitoring, Routine/Repeat (SWTR-Filter)		
Contaminant:	SWTR		
Compliance Period:	1995-06-01 - 1995-06-30	Analytical Value:	00000000.00
Violation ID:	9534066	Enforcement ID:	9554481
Enforcement Date:	1995-08-24	Enf. Action:	State Public Notif Requested
System Name:	GOLCONDA		
Violation Type:	Monitoring, Routine Major (TCR)		
Contaminant:	COLIFORM (TCR)		
Compliance Period:	1995-07-01 - 1995-07-31	Analytical Value:	00000000.00
Violation ID:	9531579	Enforcement ID:	9650673
Enforcement Date:	1995-10-01	Enf. Action:	State Violation/Reminder Notice
System Name:	GOLCONDA		
Violation Type:	Monitoring, Routine Major (TCR)		
Contaminant:	COLIFORM (TCR)		
Compliance Period:	1995-07-01 - 1995-07-31	Analytical Value:	00000000.00
Violation ID:	9531579	Enforcement ID:	9650674
Enforcement Date:	1995-10-01	Enf. Action:	State Public Notif Requested
System Name:	GOLCONDA		
Violation Type:	Monitoring, Routine Major (TCR)		
Contaminant:	COLIFORM (TCR)		
Compliance Period:	1995-07-01 - 1995-07-31	Analytical Value:	00000000.00
Violation ID:	9531579	Enforcement ID:	9700001E
Enforcement Date:	1997-06-30	Enf. Action:	EPA Generated Implicit TCR RTC
System Name:	GOLCONDA		
Violation Type:	Monitoring, Regular		
Contaminant:	ATRAZINE		
Compliance Period:	1995-07-01 - 1995-09-30	Analytical Value:	00000000.00
Violation ID:	9531578	Enforcement ID:	Not Reported
Enforcement Date:	Not Reported	Enf. Action:	Not Reported

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

To maintain currency of the following federal and state databases, EDR contacts the appropriate governmental agency on a monthly or quarterly basis, as required.

Elapsed ASTM days: Provides confirmation that this EDR report meets or exceeds the 90-day updating requirement of the ASTM standard.

FEDERAL ASTM RECORDS:

CERCLIS: Comprehensive Environmental Response, Compensation, and Liability Information System
Source: EPA
Telephone: 703-413-0223
CERCLIS contains data on potentially hazardous waste sites that have been reported to the USEPA by states, municipalities, private companies and private persons, pursuant to Section 103 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). CERCLIS contains sites which are either proposed to or on the National Priorities List (NPL) and sites which are in the screening and assessment phase for possible inclusion on the NPL.

Date of Government Version: 04/21/99
Date Made Active at EDR: 06/09/99
Database Release Frequency: Quarterly
Date of Data Arrival at EDR: 05/14/99
Elapsed ASTM days: 26
Date of Last EDR Contact: 03/03/99

ERNS: Emergency Response Notification System
Source: EPA/NTIS
Telephone: 202-260-2342
Emergency Response Notification System. ERNS records and stores information on reported releases of oil and hazardous substances.

Date of Government Version: 12/31/98
Date Made Active at EDR: 01/18/99
Database Release Frequency: Quarterly
Date of Data Arrival at EDR: 01/13/99
Elapsed ASTM days: 5
Date of Last EDR Contact: 01/04/99

NPL: National Priority List
Source: EPA
Telephone: N/A
National Priorities List (Superfund). The NPL is a subset of CERCLIS and identifies over 1,200 sites for priority cleanup under the Superfund Program. NPL sites may encompass relatively large areas. As such, EDR provides polygon coverage for over 1,000 NPL site boundaries produced by EPA's Environmental Photographic Interpretation Center (EPIC).

Date of Government Version: 05/10/99
Date Made Active at EDR: 06/09/99
Database Release Frequency: Semi-Annually
Date of Data Arrival at EDR: 05/12/99
Elapsed ASTM days: 28
Date of Last EDR Contact: 02/08/99

RCRIS: Resource Conservation and Recovery Information System
Source: EPA/NTIS
Telephone: 800-424-9346
Resource Conservation and Recovery Information System. RCRIS includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA).

Date of Government Version: 04/26/99
Date Made Active at EDR: 06/09/99
Database Release Frequency: Semi-Annually
Date of Data Arrival at EDR: 05/14/99
Elapsed ASTM days: 26
Date of Last EDR Contact: 03/31/99

CORRACTS: Corrective Action Report
Source: EPA
Telephone: 800-424-9346
CORRACTS identifies hazardous waste handlers with RCRA corrective action activity.

Date of Government Version: 03/01/99
Date Made Active at EDR: 04/16/99
Database Release Frequency: Semi-Annually
Date of Data Arrival at EDR: 03/17/99
Elapsed ASTM days: 30
Date of Last EDR Contact: 03/16/99

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

FEDERAL NON-ASTM RECORDS:

BRS: Biennial Reporting System
Source: EPA/NTIS
Telephone: 800-424-9346
The Biennial Reporting System is a national system administered by the EPA that collects data on the generation and management of hazardous waste. BRS captures detailed data from two groups: Large Quantity Generators (LQG) and Treatment, Storage, and Disposal Facilities.

Date of Government Version: 12/31/95
Database Release Frequency: Biennially

Date of Last EDR Contact: 03/25/99
Date of Next Scheduled EDR Contact: 06/21/99

CONSENT: Superfund (CERCLA) Consent Decrees
Source: EPA Regional Offices
Telephone: Varies
Major legal settlements that establish responsibility and standards for cleanup at NPL (Superfund) sites. Released periodically by United States District Courts after settlement by parties to litigation matters.

Date of Government Version: Varies
Database Release Frequency: Varies

Date of Last EDR Contact: Varies
Date of Next Scheduled EDR Contact: N/A

FINDS: Facility Index System/Facility Identification Initiative Program Summary Report
Source: EPA
Telephone: N/A
Facility Index System. FINDS contains both facility information and 'pointers' to other sources that contain more detail. EDR includes the following FINDS databases in this report: PCS (Permit Compliance System), AIRS (Aerometric Information Retrieval System), DOCKET (Enforcement Docket used to manage and track information on civil judicial enforcement cases for all environmental statutes), FURS (Federal Underground Injection Control), C-DOCKET (Criminal Docket System used to track criminal enforcement actions for all environmental statutes), FFIS (Federal Facilities Information System), STATE (State Environmental Laws and Statutes), and PADS (PCB Activity Data System).

Date of Government Version: 04/01/99
Database Release Frequency: Quarterly

Date of Last EDR Contact: 04/16/99
Date of Next Scheduled EDR Contact: 07/12/99

HMIRS: Hazardous Materials Information Reporting System
Source: U.S. Department of Transportation
Telephone: 202-366-4526
Hazardous Materials Incident Report System. HMIRS contains hazardous material spill incidents reported to DOT.

Date of Government Version: 12/31/97
Database Release Frequency: Annually

Date of Last EDR Contact: 03/24/99
Date of Next Scheduled EDR Contact: 04/26/99

MLTS: Material Licensing Tracking System
Source: Nuclear Regulatory Commission
Telephone: 301-415-7169
MLTS is maintained by the Nuclear Regulatory Commission and contains a list of approximately 8,100 sites which possess or use radioactive materials and which are subject to NRC licensing requirements. To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 12/08/98
Database Release Frequency: Quarterly

Date of Last EDR Contact: 03/02/99
Date of Next Scheduled EDR Contact: 05/31/99

NPL LIENS: Federal Superfund Liens
Source: EPA
Telephone: 205-564-4267
Federal Superfund Liens. Under the authority granted the USEPA by the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980, the USEPA has the authority to file liens against real property in order to recover remedial action expenditures or when the property owner receives notification of potential liability. USEPA compiles a listing of filed notices of Superfund Liens.

Date of Government Version: 10/15/91
Database Release Frequency: No Update Planned

Date of Last EDR Contact: 02/22/98
Date of Next Scheduled EDR Contact: 05/24/99

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

PADS: PCB Activity Database System
Source: EPA
Telephone: 202-260-3936
PCB Activity Database. PADS identifies generators, transporters, commercial storers and/or brokers and disposers of PCB's who are required to notify the EPA of such activities.

Date of Government Version: 09/22/97
Database Release Frequency: No Update Planned

Date of Last EDR Contact: 03/05/99
Date of Next Scheduled EDR Contact: 05/17/99

RAATS: RCRA Administrative Action Tracking System
Source: EPA
Telephone: 202-564-4104
RCRA Administration Action Tracking System. RAATS contains records based on enforcement actions issued under RCRA pertaining to major violators and includes administrative and civil actions brought by the EPA. For administration actions after September 30, 1995, data entry in the RAATS database was discontinued. EPA will retain a copy of the database for historical records. It was necessary to terminate RAATS because a decrease in agency resources made it impossible to continue to update the information contained in the database.

Date of Government Version: 04/17/95
Database Release Frequency: No Update Planned

Date of Last EDR Contact: 03/15/99
Date of Next Scheduled EDR Contact: 06/14/99

ROD: Records Of Decision
Source: NTIS
Telephone: 703-416-0223
Record of Decision. ROD documents mandate a permanent remedy at an NPL (Superfund) site containing technical and health information to aid in the cleanup.

Date of Government Version: 01/31/99
Database Release Frequency: Annually

Date of Last EDR Contact: 04/19/99
Date of Next Scheduled EDR Contact: 07/19/99

TRIS: Toxic Chemical Release Inventory System
Source: EPA
Telephone: 202-260-1531
Toxic Release Inventory System. TRIS identifies facilities which release toxic chemicals to the air, water and land in reportable quantities under SARA Title III Section 313.

Date of Government Version: 12/31/97
Database Release Frequency: Annually

Date of Last EDR Contact: 04/01/99
Date of Next Scheduled EDR Contact: 06/28/99

TSCA: Toxic Substances Control Act
Source: EPA
Telephone: 202-260-1444
Toxic Substances Control Act. TSCA identifies manufacturers and importers of chemical substances included on the TSCA Chemical Substance Inventory list. It includes data on the production volume of these substances by plant site.

Date of Government Version: 12/31/94
Database Release Frequency: Every 4 Years

Date of Last EDR Contact: 04/26/99
Date of Next Scheduled EDR Contact: 07/26/99

MINES: Mines Master Index File
Source: Department of Labor, Mine Safety and Health Administration
Telephone: 303-231-5959

Date of Government Version: 08/01/98
Database Release Frequency: Semi-Annually

Date of Last EDR Contact: 04/08/99
Date of Next Scheduled EDR Contact: 07/05/99

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

STATE OF ILLINOIS ASTM RECORDS:

LUST: Leaking Underground Storage Tank Sites
Source: Illinois Environmental Protection Agency
Telephone: 217-782-6760
Leaking Underground Storage Tank Incident Reports. LUST records contain an inventory of reported leaking underground storage tank incidents. Not all states maintain these records, and the information stored varies by state.

Date of Government Version: 03/01/99
Date Made Active at EDR: 04/21/99
Database Release Frequency: Semi-Annually

Date of Data Arrival at EDR: 03/22/99
Elapsed ASTM days: 30
Date of Last EDR Contact: 03/02/99

SHWS: State Oversight List
Source: Illinois Environmental Protection Agency
Telephone: 217-524-4863
State Hazardous Waste Sites. State hazardous waste site records are the states' equivalent to CERCLIS. These sites may or may not already be listed on the federal CERCLIS list. Priority sites planned for cleanup using state funds (state equivalent of Superfund) are identified along with sites where cleanup will be paid for by potentially responsible parties. Available information varies by state.

Date of Government Version: 12/07/98
Date Made Active at EDR: 01/26/99
Database Release Frequency: Semi-Annually

Date of Data Arrival at EDR: 12/23/98
Elapsed ASTM days: 34
Date of Last EDR Contact: 03/02/99

LF: Available Disposal for Solid Waste in Illinois - Solid Waste Landfills Subject to State Surcharge
Source: Illinois Environmental Protection Agency
Telephone: 217-785-8604
Solid Waste Facilities/Landfill Sites. SWF/LF type records typically contain an inventory of solid waste disposal facilities or landfills in a particular state. Depending on the state, these may be active or inactive facilities or open dumps that failed to meet RCRA Subtitle D Section 4004 criteria for solid waste landfills or disposal sites.

Date of Government Version: 12/01/98
Date Made Active at EDR: 03/25/99
Database Release Frequency: Annually

Date of Data Arrival at EDR: 02/26/99
Elapsed ASTM days: 27
Date of Last EDR Contact: 02/15/99

UST: STC (State, Town, County) Facility List
Source: Illinois State Fire Marshal
Telephone: 217-785-0969
Registered Underground Storage Tanks. UST's are regulated under Subtitle I of the Resource Conservation and Recovery Act (RCRA) and must be registered with the state department responsible for administering the UST program. Available information varies by state program.

Date of Government Version: 03/03/98
Date Made Active at EDR: 08/21/98
Database Release Frequency: Quarterly

Date of Data Arrival at EDR: 07/23/98
Elapsed ASTM days: 29
Date of Last EDR Contact: 04/05/99

STATE OF ILLINOIS NON-ASTM RECORDS:

NIPC: Solid Waste Landfill Inventory
Source: Northeastern Illinois Planning Commission
Telephone: 312-454-0400
Solid Waste Landfill Inventory. NIPC is an inventory of active and inactive solid waste disposal sites, based on state, local government and historical archive data. Included are numerous sites which previously had never been identified largely because there was no obligation to register such sites prior to 1971.

Date of Government Version: 08/01/88
Database Release Frequency: No Update Planned

Date of Last EDR Contact: 06/11/97
Date of Next Scheduled EDR Contact: N/A

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

CAT: Category List
Source: Illinois EPA
Telephone: N/A
Sites on this list are: Notice of Response Action, NPL, Pre/ osed NPL, Completed Remedial Action, Site Remediation Program, Federal Facilities, and Cleanup St d and/or Completed Sites.

Date of Government Version: 06/01/97
Database Release Frequency: No Update Planned

Date of Last EDR Contact: 03/02/99
Date of Next Scheduled EDR Contact: 05/31/99

Historical and Other Database(s)

Depending on the geographic area covered by this report, the data provided in these specialty databases may or may not be complete. For example, the existence of wetlands information data in a specific report does not mean that all wetlands in the area covered by the report are included. Moreover, the absence of any reported wetlands information does not necessarily mean that wetlands do not exist in the area covered by the report.

Former Manufactured Gas (Coal Gas) Sites: The existence and location of Coal Gas sites is provided exclusively to EDR by Real Property Scan, Inc. ©Copyright 1993 Real Property Scan, Inc. For a technical description of the types of hazards which may be found at such sites, contact your EDR customer service representative.

DELISTED NPL: NPL Deletions
Source: EPA
Telephone: N/A
The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establishes the criteria that the EPA uses to delete sites from the NPL. In accordance with 40 CFR 300.425.(e), sites may be deleted from the NPL where no further response is appropriate.

Date of Government Version: 04/23/99
Date Made Active at EDR: 06/09/99
Database Release Frequency: Semi-Annually

Date of Data Arrival at EDR: 05/12/99
Elapsed ASTM days: 28
Date of Last EDR Contact: 02/08/99

NFRAP: No Further Remedial Action Planned
Source: EPA
Telephone: 703-413-0223
As of February 1995, CERCLIS sites designated "No Further Remedial Action Planned" (NFRAP) have been removed from CERCLIS. NFRAP sites may be sites where, following an initial investigation, no contamination was found, contamination was removed quickly without the need for the site to be placed on the NPL, or the contamination was not serious enough to require Federal Superfund action or NPL consideration. EPA has removed approximately 25,000 NFRAP sites to lift the unintended barriers to the redevelopment of these properties and has archived them as historical records so EPA does not needlessly repeat the investigations in the future. This policy change is part of the EPA's Brownfields Redevelopment Program to help cities, states, private investors and affected citizens to promote economic redevelopment of unproductive urban sites.

Date of Government Version: 04/21/99
Date Made Active at EDR: 06/09/99
Database Release Frequency: Quarterly

Date of Data Arrival at EDR: 05/14/99
Elapsed ASTM days: 26
Date of Last EDR Contact: 03/03/99

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

PWS: Public Water Systems
Source: EPA/Office of Drinking Water
Telephone: 202-260-2805
Public Water System data from the Federal Reporting Data System. A PWS is any water system which provides water to at least 25 people for at least 60 days annually. PWSs provide water from wells, rivers and other sources.

PWS ENF: Public Water Systems Violation and Enforcement Data
Source: EPA/Office of Drinking Water
Telephone: 202-260-2805
Violation and Enforcement data for Public Water Systems from the Safe Drinking Water Information System (SWDIS) after August 1995. Prior to August 1995, the data came from the Federal Reporting Data System (FRDS).

Area Radon Information: The National Radon Database has been developed by the U.S. Environmental Protection Agency (USEPA) and is a compilation of the EPA/State Residential Radon Survey and the National Residential Radon Survey. The study covers the years 1986 - 1992. Where necessary data has been supplemented by information collected at private sources such as universities and research institutions.

EPA Radon Zones: Sections 307 & 309 of IRAA directed EPA to list and identify areas of U.S. with the potential for elevated indoor radon levels.

Oil/Gas Pipelines/Electrical Transmission Lines: This data was obtained by EDR from the USGS in 1994. It is referred to by USGS as GeoData Digital Line Graphs from 1:100,000-Scale Maps. It was extracted from the transportation category including some oil, but primarily gas pipelines and electrical transmission lines.

Sensitive Receptors: There are individuals deemed sensitive receptors due to their fragile immune systems and special sensitivity to environmental discharges. These sensitive receptors typically include the elderly, the sick, and children. While the location of all sensitive receptors cannot be determined, EDR indicates those buildings and facilities - schools, daycares, hospitals, medical centers, and nursing homes - where individuals who are sensitive receptors are likely to be located.

USGS Water Wells: In November 1971 the United States Geological Survey (USGS) implemented a national water resource information tracking system. This database contains descriptive information on sites where the USGS collects or has collected data on surface water and/or groundwater. The groundwater data includes information on more than 900,000 wells, springs, and other sources of groundwater.

Flood Zone Data: This data, available in select counties across the country, was obtained by EDR in 1999 from the Federal Emergency Management Agency (FEMA). Data depicts 100-year and 500-year flood zones as defined by FEMA.

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in March 1997 from the U.S. Fish and Wildlife Service.

Epicenters: World earthquake epicenters, Richter 5 or greater
Source: Department of Commerce, National Oceanic and Atmospheric Administration

Water Dams: National Inventory of Dams
Source: Federal Emergency Management Agency
Telephone: 202-646-2801
National computer database of more than 74,000 dams maintained by the Federal Emergency Management Agency.

County Well Data in Illinois: Cook and DuPage Counties
Source: Illinois State Geological Survey
Telephone: 217-244-2387

Illinois Private Well Database and PICS (Public, Industrial, Commercial Survey)
Source: Illinois State Water Survey
Telephone: 217-333-9043

Illinois State Geological Survey Water Wells
Source: Illinois State Geological Survey
Telephone: 217-333-5102
Point data set that shows locations, well type, and well ID for wells in Illinois. Data comes from driller's logs.

APPENDIX C Plan Formulation and Incremental Analysis Checklist

Project Site Location:

The Barren Creek and Big Bay Creek Embayment Project area is located in Pope County, Illinois approximately 11.6 miles northeast of Paducah, Kentucky. The project site is in Ohio River Smithland Pool between Ohio River Mile (ORM) 909.4 and 910.9.

Description of Plan selected:

The Barren Creek and Big Bay Creek Embayment project is designed to provide shallow water and rock spawning habitat for fish and to restore/maintain the openings to the Barren Creek and Big Bay Creek embayments. The project will include: 1) The opening for Barren Creek would require maintenance dredging; 2) Installation of the hard point structures at the mouths of Barren Creek and Big Bay Creek; and 3) Big Bay Creek would require the installation/construction of a rock revetment to protect the eroding river bank.

Alternatives of the Selected Plan:

Smaller Size Plans Possible? Yes / No and description

Larger Size Plan Possible? Yes / No and description

Other alternatives? Yes

An island with back channel can be formed at Big Bay Creek through the use of dredging and a hard point structure.

Restore/Enhance/Protect Terrestrial Habitats? [ ] **Opportunity numbers met** [T2]

Restore, Enhance, & Protect Wetlands? [ ] **Opportunity numbers met** [ ]

Restore/Enhance/Protect Aquatic Habitats? [Yes] **Opportunity numbers met** [A1, A6]

Type species benefited: Fish and invertebrates including mussels

Endangered species benefited: Potential benefits to mussel species

Can estimated amount of habitat units be determined:

Plan acceptable to Resources Agencies?

U.S. Fish & Wildlife Service?

State Department of Natural Resources? Yes – Illinois DNR

Plan considered complete? **Connected to other plans for restoration?**

Real Estate owned by State Agency? **Federal Agency?**
Real Estate privately owned? Yes
If privately owned, what is status of future acquisition? Unknown

Terrestrial Habitat Opportunities

T1- Restore riparian corridors, reduce fragmentation by expanding and joining isolated habitat blocks and stabilize eroding banks.

T2 Restore, protect existing islands and create islands where they historically occurred.

T3 Restore hardwood forests in the 100-year floodplain.

Wetland Habitat Opportunities

W1 Forested Wetlands: Restore Forested Wetlands: Bottomland Hardwoods

W2 Forested Wetlands: Restore Forested Wetlands:Cypress/Tupelo Swamps and other unique forested wetlands

W3 Restore Scrub/Shrub Emergent Wetlands: including those areas isolated from the river except during high water and those contiguous with embayments and island sloughs.

Aquatic Habitat Opportunities

A1 Restore backwaters (Including sloughs, embayments, oxbows, bayous, etc.).

A2 Restore riverine submerged and emergent aquatic vegetation

A3 Restore and protect sand and gravel bars.

A4 Protect tailwaters and provide structures to provide refuge for fish.

A5 Create and protect fish and mussel refuges in pools (deep water, slow velocity, soft substrate)

A6 Restore and protect aquatic habitat (Side Channel/Back Channel Habitat)

Other

O-1 Restore other habitats(e.g., canebrakes, river bluffs mussel beds, etc.)

APPENDIX D Micro Computer-Aided Cost Engineering System (MCACES)

Barren & Big Bay Embayment
Ohio River Mainstem
Ecosystem Restoration Project

Sample Feasibility Cost Estimate

Designed By: Parsons Engineering Science, Inc
Estimated By:

Prepared By: Parsons Engineering/CELRL-ED-MC
CELRL-ED-MC POC: M. Lockard

Preparation Date: 06/20/00
Effective Date of Pricing: 06/20/00
Est Construction Time: 365 Days

Sales Tax: 0.00%

M C A C E S G O L D E D I T I O N
Composer GOLD Software Copyright (c) 1985-1994
by Building Systems Design, Inc.
Release 5.30A

ABOR ID: FTCAMP EQUIP ID: NAT97A Currency in DOLLARS CREW ID: NAT99A UPB ID: UP99EA

arren Creek and Big Bay Cre	QUANTY	UOM	CREW ID	OUTPUT	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT
Lands and Damages					0	0	0	39,000	39,000	
Habitat & Feeding Facilities										
Barren Creek Embayment										
Mobilization										
Dredge	2.00	LS		0.53	5,800	8,700	0	0	14,500	7250.00
Bull Dozer	2.00	LS		6.00	59	304	0	0	363	181.50
Vibrating Roller	2.00	LS		6.00	59	304	0	0	363	181.50
Contingencies	1.00	LS		6.00	0	0	0	5,994	5,994	5994.00
Mobilization					5,918	9,308	0	5,994	21,220	
Dredging										
AUGERHD MUDCAT, 8" DISCHARGE DIA	63.33	HR	M10EL007	90.00	0	2,979	0	0	2,979	47.04
Outside Laborer	126.67	HR	X-LABORER	0.00	2,889	0	0	0	2,889	22.81
Outside Equip. Op. Medium	63.33	HR	X-EQOPRMED	0.00	1,283	0	0	0	1,283	20.25
Dredging	3800.00	CY			4,172	2,979	0	0	7,151	1.88
Geotube Levee										
Bulk Site Exc & Shaping, Sm Area	800.00	CY	CODTA	46.88	2,853	307	0	0	3,161	3.95
Small Dozer										
Geotubes	6.00	EA		0.00	0	0	156	1,200	1,356	226.00
Material cost is for 45'Circumference Geotubes at 200' long.										
Other cost is for unloading and position into place and other misc costs associated with tube handling.										

Geotube Levee	6.00	LA		2,853	307	156	1,200	4,517	752.77
EXCAVATION									
HYD EXCAV, CRWLR, 2.50 CY BKT	6.43	HR	H25BA004	1.00	0	457	0	0	457	71.16
Outside Equip. Op. Medium	6.43	HR	X-EQOPRMED	1.00	130	0	0	0	130	20.25
WORK FLOAT, MED DUTY, 30'X10'X3'	6.43	HR	M10MZ003	1.00	0	11	0	0	11	1.71
Outside Laborer	6.43	HR	X-LABORER	1.00	147	0	0	0	147	22.81
TUG BOAT, 150 TO 40O HP	6.43	HR	XX0XX004	1.00	0	165	0	0	165	25.66

ABOR ID: FTCAMP EQUIP ID: NAT97A Currency in DOLLARS CREW ID: NAT99A UPB ID: UP99EA

arren Creek and Big Bay Cre	QUANTY	UOM	CREW ID	OUTPUT	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT
Outside Equip. Op. Medium	6.43	HR	X-EQOPRMED	1.00	130	0	0	0	130	20.25
TUG BOAT, 500 TO 80O HP	6.43	HR	XX0XX002	1.00	0	409	0	0	409	63.68
Outside Equip. Op. Medium	6.43	HR	X-EQOPRMED	1.00	130	0	0	0	130	20.25
WORK BARGE-S,MED DUTY,60'X1 6'X5'	51.43	HR	M10MZ009	1.00	0	274	0	0	274	5.32
Outside Laborer	6.43	HR	X-LABORER	1.00	150	0	0	0	150	23.31
Outside Laborer	6.43	HR	X-LABORER	1.00	147	0	0	0	147	22.81
EXCAVATION	900.00	CY			834	1,317	0	0	2,150	2.39
ROCK										
HYD EXCAV, CRWLR, 2.50 CY B KT	15.49	HR	H25BA004	1.00	0	1,102	0	0	1,102	71.16
Outside Equip. Op. Medium	15.49	HR	X-EQOPRMED	1.00	314	0	0	0	314	20.25
WORK FLOAT, MED DUTY, 30'X1 0'X3'	15.49	HR	M10MZ003	1.00	0	27	0	0	27	1.71
Outside Laborer	15.49	HR	X-LABORER	1.00	353	0	0	0	353	22.81
TUG BOAT, 150 TO 40O HP	15.49	HR	XX0XX004	1.00	0	397	0	0	397	25.66
Outside Equip. Op. Medium	15.49	HR	X-EQOPRMED	1.00	314	0	0	0	314	20.25
TUG BOAT, 500 TO 80O HP	15.49	HR	XX0XX002	1.00	0	986	0	0	986	63.68
Outside Equip. Op. Medium	15.49	HR	X-EQOPRMED	1.00	314	0	0	0	314	20.25
WORK BARGE-S,MED DUTY,60'X1 6'X5'	123.89	HR	M10MZ009	1.00	0	660	0	0	660	5.32
Outside Laborer	15.49	HR	X-LABORER	1.00	361	0	0	0	361	23.31
Outside Laborer	15.49	HR	X-LABORER	1.00	353	0	0	0	353	22.81
Rip Rap, 10# to 200# Pieces Random, Dumped from Truck onto barge to be shipped to site.	2168.00	CY	COETF	32.00	24,676	3,520	52,856	0	81,052	37.39
ROCK	2168.00	CY			26,684	6,691	52,856	0	86,231	39.77
Geofabric										
Erosion Control,18 Mil Viny l Mat 3 Dimensional, Nylon Geomatrix	900.00	SY	ULABK	57.50	1,079	55	4,431	0	5,565	6.18
Erosion Control, Slope Stak es Required 3' to 5' Intervals	1575.00	EA	N/A	0.00	0	0	488	0	488	0.31

Geofabric	900.00 SY		1,079	55	4,919	0	6,053	6.73
	Mussel Survey							
Mussel Survey	1.00 LS	0.00	0	0	0	5,000	5,000	5000.00
Mussel Survey			0	0	0	5,000	5,000	

ABOR ID: FTCAMP EQUIP ID: NAT97A Currency in DOLLARS CREW ID: NAT99A UPB ID: UP99EA

arren Creek and Big Bay Cre	QUANTY	UOM	CREW ID	OUTPUT	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT
Barren Creek Embayment					41,540	20,657	57,931	12,194	132,323	
Big Bay Creek Embayment										
EXCAVATION										
HYD EXCAV, CRWLR, 2.50 CY B KT	15.71	HR	H25BA004	1.00	0	1,118	0	0	1,118	71.16
Outside Equip. Op. Medium	15.71	HR	X-EQOPRMED	1.00	318	0	0	0	318	20.25
WORK FLOAT, MED DUTY, 30'X10'X3'	15.71	HR	M10MZ003	1.00	0	27	0	0	27	1.71
Outside Laborer	15.71	HR	X-LABORER	1.00	358	0	0	0	358	22.81
TUG BOAT, 150 TO 400 HP	15.71	HR	XX0XX004	1.00	0	403	0	0	403	25.66
Outside Equip. Op. Medium	15.71	HR	X-EQOPRMED	1.00	318	0	0	0	318	20.25
TUG BOAT, 500 TO 800 HP	15.71	HR	XX0XX002	1.00	0	1,001	0	0	1,001	63.68
Outside Equip. Op. Medium	15.71	HR	X-EQOPRMED	1.00	318	0	0	0	318	20.25
WORK BARGE-S,MED DUTY,60'X16'X5'	125.71	HR	M10MZ009	1.00	0	669	0	0	669	5.32
Outside Laborer	15.71	HR	X-LABORER	1.00	366	0	0	0	366	23.31
Outside Laborer	15.71	HR	X-LABORER	1.00	358	0	0	0	358	22.81
EXCAVATION	2200.00	CY			2,038	3,218	0	0	5,256	2.39
ROCK										
HYD EXCAV, CRWLR, 2.50 CY B KT	43.45	HR	H25BA004	1.00	0	3,092	0	0	3,092	71.16
Outside Equip. Op. Medium	43.45	HR	X-EQOPRMED	1.00	880	0	0	0	880	20.25
WORK FLOAT, MED DUTY, 30'X10'X3'	43.45	HR	M10MZ003	1.00	0	74	0	0	74	1.71
Outside Laborer	43.45	HR	X-LABORER	1.00	991	0	0	0	991	22.81
TUG BOAT, 150 TO 400 HP	43.45	HR	XX0XX004	1.00	0	1,115	0	0	1,115	25.66
Outside Equip. Op. Medium	43.45	HR	X-EQOPRMED	1.00	880	0	0	0	880	20.25
TUG BOAT, 500 TO 800 HP	43.45	HR	XX0XX002	1.00	0	2,767	0	0	2,767	63.68
Outside Equip. Op. Medium	43.45	HR	X-EQOPRMED	1.00	880	0	0	0	880	20.25
WORK BARGE-S,MED DUTY,60'X16'X5'	347.60	HR	M10MZ009	1.00	0	1,851	0	0	1,851	5.32
Outside Laborer	43.45	HR	X-LABORER	1.00	1,013	0	0	0	1,013	23.31
Outside Laborer	43.45	HR	X-LABORER	1.00	991	0	0	0	991	22.81
Rip Rap, 10# to 200# Pieces	6083.00	CY	COETF	32.00	69,237	9,875	148,304	0	227,415	37.39

Random, Dumped from truck onto
barge to be shipped to site.

ROCK	6083.00 CY	74,871	18,774	148,304	0	241,949	39.77

ABOR ID: FTCAMP EQUIP ID: NAT97A Currency in DOLLARS CREW ID: NAT99A UPB ID: UP99EA

arren Creek and Big Bay Cre	QUANTY	UOM	CREW ID	OUTPUT	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT
Geofabric										
Erosion Control,18 Mil Viny l Mat	9150.00	SY	ULABK	57.50	10,968	556	45,050	0	56,574	6.18
3 Dimensional, Nylon Geomatrix										
Erosion Control, Slope Stak es	16013	EA	N/A	0.00	0	0	4,964	0	4,964	0.31
Required 3' to 5' Intervals										
Geofabric	9150.00	SY			10,968	556	50,014	0	61,538	6.73
Mobilization										
mobilization	1.00	LS		0.00	0	0	0	61,740	61,740	61740
Mobilization					0	0	0	61,740	61,740	
Mussel Survey										
Mussel Survey	1.00	LS		0.00	0	0	0	5,000	5,000	5000.00
Mussel Survey					0	0	0	5,000	5,000	
Big Bay Creek Embayment					87,877	22,549	198,317	66,740	375,484	
Habitat & Feeding Facilitie					129,417	43,206	256,249	78,934	507,806	
Planning, Engineering & Des					0	0	0	90,800	90,800	
Engineering During Constuct					0	0	0	8,300	8,300	
Construction Management					0	0	0	50,700	50,700	
Barren Creek and Big Bay Cr					129,417	43,206	256,249	267,734	696,606	
Illinois					129,417	43,206	256,249	267,734	696,606	
Barren & Big Bay Embayment					129,417	43,206	256,249	267,734	696,606	

ABOR ID: FTCAMP EQUIP ID: NAT97A Currency in DOLLARS CREW ID: NAT99A UPB ID: UP99EA

		QUANTY	UOM	CONTRACT	CONTINGN	TOTAL COST	UNIT
01	Illinois						
01-01	Barren Creek and Big Bay Creek						
01-01{ 0100	Lands and Damages			39,000	6,000	45,000	
01-01{ 0603	Fish & Wildlife Facilities and			633,848	158,462	792,310	
01-01{ 3000	Planning, Engineering & Design			99,100	19,820	118,920	
01-01{ 3100	Construction Management			50,700	10,140	60,840	
	TOTAL Barren Creek and Big Bay Creek			822,648	194,422	1,017,070	
	TOTAL Illinois			822,648	194,422	1,017,070	
	TOTAL Barren & Big Bay Embayment			822,648	194,422	1,017,070	

ABOR ID: FTCAMP EQUIP ID: NAT97A Currency in DOLLARS CREW ID: NAT99A UPB ID: UP99EA

	QUANTY	UOM	CONTRACT	CONTINGN	TOTAL COST	UNIT
01 Illinois						
01-01 Barren Creek and Big Bay Creek						
01-01{ 0100 Lands and Damages						
01-01{ 010001 Lands and Damages			39,000	6,000	45,000	
TOTAL Lands and Damages			39,000	6,000	45,000	
01-01{ 0603 Fish & Wildlife Facilities and						
01-01{ 060373 Habitat & Feeding Facilities						
01-01{ 060373}1 Barren Creek Embayment						
01-01{ 060373}1. 1 Mobilization			26,487	6,622	33,109	
01-01{ 060373}1. 2 Dredging	3800.00	CY	8,926	2,232	11,158	2.94
01-01{ 060373}1. 3 Geotube Levee	6.00	EA	5,638	1,409	7,047	1174.52
01-01{ 060373}1. 4 EXCAVATION	900.00	CY	2,684	671	3,355	3.73
01-01{ 060373}1. 5 ROCK	2168.00	CY	107,635	26,909	134,543	62.06
01-01{ 060373}1. 6 Geofabric	900.00	SY	7,555	1,889	9,444	10.49
01-01{ 060373}1. 7 Mussel Survey			6,241	1,560	7,801	
TOTAL Barren Creek Embayment			165,166	41,292	206,458	
01-01{ 060373}2 Big Bay Creek Embayment						
01-01{ 060373}2. 1 EXCAVATION	2200.00	CY	6,561	1,640	8,201	3.73
01-01{ 060373}2. 2 ROCK	6083.00	CY	302,003	75,501	377,504	62.06
01-01{ 060373}2. 3 Geofabric	9150.00	SY	76,813	19,203	96,016	10.49
01-01{ 060373}2. 4 Mobilization			77,064	19,266	96,330	
01-01{ 060373}2. 5 Mussel Survey			6,241	1,560	7,801	
TOTAL Big Bay Creek Embayment			468,682	117,171	585,853	
TOTAL Habitat & Feeding Facilities			633,848	158,462	792,310	

TOTAL Fish & Wildlife Facilities and	633,848	158,462	792,310
01-01{ 3000 Planning, Engineering & Design			
01-01{ 300001 Planning, Engineering & Design	90,800	18,160	108,960
01-01{ 300002 Engineering During Constuction	8,300	1,660	9,960
TOTAL Planning, Engineering & Design	99,100	19,820	118,920

	QUANTY	UOM	CONTRACT	CONTINGN	TOTAL COST	UNIT
01-01{ 3100 Construction Management						
01-01{ 310001 Construction Management			50,700	10,140	60,840	
TOTAL Construction Management			50,700	10,140	60,840	
TOTAL Barren Creek and Big Bay Creek			822,648	194,422	1,017,070	
TOTAL Illinois			822,648	194,422	1,017,070	
TOTAL Barren & Big Bay Embayment			822,648	194,422	1,017,070	

ABOR ID: FTCAMP EQUIP ID: NAT97A Currency in DOLLARS CREW ID: NAT99A UPB ID: UP99EA

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ABOR ID: FTCAMP EQUIP ID: NAT97A Currency in DOLLARS CREW ID: NAT99A UPB ID: UP99EA

SUMMARY REPORTS SUMMARY PAGE

DETAILED ESTIMATE DETAIL PAGE

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EXHIBIT H-3

July 2000

PRELIMINARY FINAL REPORT

INCREMENTAL ANALYSIS OF THE BARREN CREEK AND BIG BAY CREEK EMBAYMENTS PROJECT, ILLINOIS

Submitted to

U.S. Army Corps of Engineer
Louisville District
Louisville, Kentucky

Submitted by

Federal Programs Division
Baton Rouge, Louisiana

July 2000

PRELIMINARY FINAL REPORT

Contract No. DACW27-99-D-0019
Delivery Order No. 0004
GEC Project No. 22321304

INCREMENTAL ANALYSIS OF THE BARREN CREEK AND BIG BAY CREEK EMBAYMENTS PROJECT, ILLINOIS

Submitted to

U.S. Army Corps of Engineers
Louisville District
Louisville, Kentucky

Submitted by

G.E.C., Inc.
Baton Rouge, Louisiana

Engineering Economics Transportation Technology Social Analysis Environmental Planning

P.O. Box 84010 Baton Rouge, Louisiana 70884-4010 (225) 612-3000 Fax (225) 612-3016
9357 Interline Avenue Baton Rouge, Louisiana 70809-1910

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1.0 INTRODUCTION, PURPOSE AND NEED

This work presents an incremental analysis of the costs and benefits of the Ohio River ecosystem restoration project IL10 – Barren Creek and Big Bay Creek Embayments, a feasibility level study associated with a proposed ecosystem restoration program for the Ohio River. This study serves as an example incremental analysis for various ecosystem components considered as part of the program. The Corps has been involved in a large ecosystem restoration study of the Ohio River extending from Cairo, Illinois, to Pittsburgh, Pennsylvania. The Louisville, Huntington, and Pittsburgh districts are currently working with other Federal agencies and six states to develop an array of ecosystem restoration projects.

The proposed Barren Creek and Big Bay Creek Embayments project is located in Pope County, Illinois, approximately 11.6 miles northeast of Paducah, Kentucky. The project site is in the Ohio River Smithland Pool between Ohio River Mile (ORM) 909.4 and 910.9 and is within the jurisdiction of the Louisville District, U.S. Army Corps of Engineers (USACE).

The Barren Creek and Big Bay Creek mouths have become clogged with sediments due to several factors. These factors include: raised water levels from the impoundments of the Smithland Pool, which reduced the headwater currents from Barren and Big Bay creeks near their mouths; deposition of silt from the main Ohio River Channel, especially during flood events; wave action from barge traffic; and headwater sediments from Barren Creek and Big Bay Creek. Barge traffic coupled with the scouring affects of the water velocities on the outside bend of the Ohio River has created the erosion problem north of the mouth of Big Bay Creek.

The primary goals of the Barren Creek and Big Bay Creek Embayment project are to provide shallow water and rock spawning habitat for fishes and to restore and maintain the openings to the Barren Creek and Big Bay Creek embayments.

The proposed location of the Barren Creek and Big Bay Creek embayment improvements would occur along the Illinois bank of the Ohio River between ORM 909.5 and 910. A narrow littoral zone extends from the bank to approximately 5 to 20 yards from the bank before dropping rapidly into the main Ohio River channel. The banks are characterized by mud/silt, and the bottom substrates are composed primarily of silt and fine sand. The Illinois bank of the Ohio River between the mouths of Big Bay Creek and Barren Creek is dominated by a narrow band of riparian trees. The dominant species present in the stand include box elder (*Acer negundo*), black willow (*Salix nigra*), cottonwood (*Populus deltoides*), and silver maple (*Acer saccharinum*). The floodplain area behind the narrow riparian stand is agricultural. There is a stand of tree stumps in the littoral zone as the result of the increased water levels associated with the completion of the Smithland Dam in the early 1980s. The increased water levels in the Smithland pool transformed the affected portions of Barren and Big Bay creeks in the project area from free flowing streams to small slackwater embayments. The increased water level killed the trees in the affected portion of the riparian zone, and the tree stumps are all that remain.

Three proposed alternatives, presented below, were designed to meet the principal goals of the project.

2.0 PROPOSED ALTERNATIVES

2.1 No-Action

With the implementation of the No-Action Alternative, the openings of Barren Creek and Big Bay Creek would continue to receive sediment from flood waters on each of the respective creeks and the Ohio River. Each of the creeks would continue to become less accessible to boating traffic and fisheries during low water flow periods. Valuable aquatic habitat would continue to be available; however, it would only be accessible during flood events.

2.2 Alternative 1. Barren Creek Embayment

The mouth of Barren Creek has become clogged with sediments. To alleviate the problem, this alternative calls for the construction of rock revetments near the mouth of the creek adjacent to the Illinois bank of the Ohio River. The opening for Barren Creek would require maintenance dredging prior to the construction of the rock revetment. Installation of the rock revetments would: (1) reduce the need for future embayment dredging by reducing sedimentation within the embayment mouths; and (2) improve habitat diversity for aquatic species such as fish and benthic invertebrates, including the federally-listed endangered fat pocketbook pearly mussel.

Maintenance dredging of the mouth of the embayment is required to reestablish a suitable depth for boater access and to provide a suitable sub-grade for the rock revetment at the mouth. Dredging of the mouth of Barren Creek would result in long-term beneficial impacts to fishes due to the improved/deepened access to the Barren Creek Embayment. Fishes would be allowed free access to the embayment, especially during low flow periods. Because habitat requirements may change seasonally, improved access to the embayment coupled with the long-term scouring of the mouth of the embayment from the placement of the rock revetment would be considered beneficial. An estimated 3,800 cubic yards of silty-clay material would be dredged to restore depths of 9 to 12 feet at the embayment mouth. A small swinging ladder, cutterhead dredge will be used for all dredging. A dredged material disposal site has been identified adjacent to the embayment. A small geotube levee 350 feet in length would be constructed at the designated disposal site for dewatering.

A rock revetment, designed to slow the rate of sedimentation in the mouth of the embayment, will be placed at the mouth of Barren Creek. This large rock structure would provide an area of increased velocities, which would create a scour hole at the embayment mouth. The structure of the rip-rap dike coupled with localized changes in flow patterns and the scouring effects downstream from the rock revetments would lead to improved habitat diversity for aquatic species. The top width of the structure will be 5 feet with 1.5 to 1 side slopes and would extend downstream at a 60-degree angle from the channel bank for 115 feet. The structure would then turn and parallel the bank for 220 feet. The dike will be toed into the sub-grade a minimum of two feet and stand above the channel bottom six feet. The top of the structure will be a minimum of three feet below the normal pool elevation of 324.0. A depth of three feet was chosen to accommodate the majority of recreational boat traffic. If deemed necessary, marker buoys would be put in place to mark the channel. The size of the rock used will be uniformly graded limestone, with each rock weighing between 50 and 100 pounds. The use of 50 to 150 pound rock is included in the project design for costing purposes and is anticipated to be appropriate for the required construction. The size of rock should be determined during the preconstruction, engineering, and design (PED) phase of the project. All rip-rap material would be shipped by barge to the project site. All costs for shipping are included in the materials costs.

Numerical or physical modeling should be used to evaluate the performance of the proposed structures to maintain the openings and evaluate any potential effects to navigation during the preconstruction, engineering, and design (PED) phase of the project.

Due to the increased velocities created by the embayment revetment, the channel bank would need to be protected. This would include cleaning the slope of all trees and brush, excavating the river bank to provide a 2 to 1 slope, covering the slope with a filter fabric, and extending rip-rap up the banks of the channel to a height of 12 feet vertically from the channel bottom. Protecting/armoring the bank near the rock revetments associated with the mouth of Barren Creek would insure that the terrestrial/riparian habitats are not eroded by the Ohio River currents. Bank stabilization at this location would be considered a long-term beneficial impact to terrestrial/riparian habitats.

2.3 Alternative 2. Big Bay Creek Embayment

To reduce sediments from depositing in the mouth of Big Bay Creek, this alternative calls for the construction of a rock revetment near the mouth of the creek adjacent to the Illinois bank of the Ohio River. The rock revetment could also protect the eroding riverbank and provide rock habitat within the project area.

A rock revetment, designed to slow the rate of sedimentation at the mouth of the embayment, will be placed at the mouth of Big Bay Creek. This large rock structure would provide an area of increased velocities, which would create a scour hole at the embayment mouth. The structure of the rip-rap dike coupled with localized changes in flow patterns and the scouring effects downstream from the rock revetments would lead to improved habitat diversity for aquatic species. The top width of the structure will be five feet with 1.5 to 1 side slopes and would extend downstream at a 60 degree angle form the channel bank for 115 feet. The structure would then turn and parallel the bank for 335 feet. The dike will be toed into the sub-grade a minimum of two feet and stand above the channel bottom six feet. The top of the structure will be a minimum of three feet below the normal pool elevation of 324.0. A depth of three feet was chosen to accommodate the majority of recreational boat traffic. If deemed necessary, marker buoys would be put in place to mark the channel. The size of the rock used will be uniformly graded limestone, with each rock weighing between 50 and 100 pounds. All rip-rap material would be shipped by barge to the project site. All costs for shipping are included in the material costs.

Numerical or physical modeling should be used to evaluate the performance of the proposed structures to maintain the openings and evaluate any potential effects to navigation during the preconstruction, engineering, and design (PED) phase of the project.

Due to the increased velocities created by the embayment revetment, the channel bank would need to be protected. This would include cleaning the slope of all trees and brush, excavating the river bank to provide a 2 to 1 slope, covering the slope with a filter fabric, and extending rip-rap up the banks of the channel to a height of 12 feet vertically from the channel bottom. Protecting/armoring the bank upstream from Big Bay Creek and near the rock revetments associated with the mouth of Big Bay Creek would insure that the terrestrial/riparian habitats are not eroded by the Ohio River currents. Bank stabilization at these locations would be considered a long-term beneficial impact to terrestrial/riparian habitats.

2.4 Alternative 3. Dredge Channel Through Big Bay Creek Peninsula

Before entering into the Ohio River, Big Bay Creek parallels the river for approximately 0.5 mile between ORM 909.5 and 910. A narrow peninsula of farmland separates Big Bay Creek and the Ohio River. The bank of the Ohio River immediately upstream from the opening of Big Bay Creek is currently being actively eroded. The bank has little woody vegetation, and the adjacent floodplain area is being farmed up to the riverbank. Small black willow saplings and a few scattered trees are present along the eroding bank; however, the riverbank is dominated by herbaceous vegetation. This bank is on the outside bend of the Ohio River, and there is no natural vegetation to control the erosive forces of the river's currents, especially during high flow periods.

This alternative calls for a channel to be cut between the main channel of the Ohio River and Big Bay Creek near ORM 909.5. The channel would be dredged 10 feet deep and 80 feet wide at the water surface through approximately 730 feet of the peninsula. This would require the excavation of approximately 91,000 cubic yards of material. Constructing the channel would change the narrow peninsula of farmland into an island. Excavated material would be disposed on the resulting island. Since this area is on the outside bend of the Ohio River, some water flow could be diverted around the island creating a back-channel off the main Ohio River channel. Placement of a hardpoint diversion structure upstream from the proposed island would enhance the amount of flow into the channel around the newly created island. The diversion structure would be constructed of rip-rap, and extend 100 feet into the river. The revetment will be toed into the subgrade a minimum of two feet and stand above the channel bottom approximately seven feet. The top of the structure will be a minimum of three feet below the normal pool elevation in order to accommodate the majority of recreational boat traffic. Armoring the upstream and main channel banks would stabilize the island, and the remainder of the island could be replanted with preferred bottomland hardwoods.

The primary benefits associated with this alternative would include more diversified aquatic habitat, improved terrestrial habitat due to reforestation, and increased recreational opportunities, especially fishing and hunting. The primary adverse issues to be considered with this alternative would be the requisite land acquisition or easement purchase of the peninsula, which is currently being partially farmed, and the short-term adverse affects during construction of the dredged channel.

3.0 COST ANALYSIS

3.1 Introduction

This section presents the findings of a cost effectiveness and incremental cost analysis of no-action, the three alternatives, and various combinations of the alternatives under consideration. These cost analyses are not intended to determine the best alternative or combination of alternatives, but rather to provide decision-makers with a comparison of alternatives that produce different levels of environmental outputs and to assist in selecting the alternative that best satisfies project objectives. The analyses are intended to improve the quality of decision-making when considering alternative plans.

The cost effectiveness and incremental cost analysis was conducted in accordance with guidelines contained in EC 1105-2-206, entitled *Project Modification for Improvement of the Environment*, which is the same guidance as EC 1105-2-210, dated June 1, 1995, entitled *Ecosystem Restoration in*

the Civil Works Program; EC 1105-2-214, dated October 3, 1998, entitled *Project Modifications for Improvement and Aquatic Ecosystem Restoration;* and Institute for Water Resources report *Evaluation of Environmental Investments Procedures Manual Interim: Cost Effectiveness and Incremental Cost Analyses,* dated May 1995 (IWR Report 95-R-1).

The Institute for Water Resources (IWR) has developed IWR-PLAN Decision Support Software to assist with the formulation and comparison of alternative plans of environmental restoration projects. IWR-PLAN assists in plan formulation by combining solutions to planning problems and calculating the additive effects of each alternative or combination of alternatives. When developing a combination of alternatives, IWR-PLAN includes each alternative in the combination, assigning either an action or no-action status to each. For instance, when evaluating a project with three alternatives, IWR-PLAN calculates total environmental output for implementing Alternative 1 as the output associated with implementing Alternative 1 plus the output (if any) associated with no-action under alternatives 2 and 3.

IWR-PLAN assists in plan formulation and comparison of alternatives by conducting cost effectiveness and incremental cost analyses. IWR-PLAN was used in conducting the cost effectiveness and incremental cost analyses for the Barren Creek and Big Bay Creek Embayments Project.

As the name indicates, cost effectiveness analysis is a method for comparing alternative plans that produce environmental outputs and determining which plan can produce the largest quantity of output for a given cost, or produce the same or greater quantity of output for less cost. Cost effectiveness analysis determines if: (1) the same environmental output level could be produced by another plan at less cost; (2) a larger environmental output level could be produced at the same cost; or (3) a larger environmental output level could be produced at less cost. For instance, if two alternatives produce the same amount of environmental outputs, the alternative with the lowest cost is considered cost effective. Likewise, if the costs of two alternatives are equal, but one produces more outputs than the other, the one producing the higher level of outputs would be the cost effective alternative. Also, an alternative that costs less and produces higher levels of output is considered to be cost effective compared to higher cost alternatives producing lower levels of output.

Incremental cost analysis builds on the findings of the cost effectiveness analysis. This is accomplished by comparing the increase in costs to the increase in outputs that are associated with advancing from one output level (one cost effective alternative) to the next higher output level (another cost effective alternative).

3.2 Cost Estimates of Alternatives

To conduct cost effectiveness and incremental cost analyses, the total cost of implementing each alternative must be estimated and stated on an average annual basis. Preliminary cost estimates for alternatives presented in the feasibility report were obtained from the Microcomputer Aided Cost Estimating System (MCACES) cost estimates developed as part of the feasibility report and additional cost elements (real estate, plans and specifications, and supervision and administration during construction). Cost estimates for alternatives developed as part of this analysis were based on MCACES per-unit costs presented in the feasibility report and calculated quantities.

3.2.1 Alternative 1. Barren Creek Embayment. The total estimated cost associated with implementing Alternative 1 is $180,991 (Table 3-1). Activities included in these costs are equipment mobilization, dredging 3,800 cubic yards of material, geotube levee construction, excavation, placement of rock revetments, placement of geofabric, and a mussel survey. Also included in the costs are contingencies, real estate costs, plans and specifications, supervision and administration during construction, and interest during construction. Interest during construction is based on the federal discount rate of 6.625 percent and a construction schedule of 26 days.

Table 3-1. Barren Creek and Big Bay Creek Embayments Project, Alternative 1, Barren Creek Embayment, Cost Estimate

Item	Costs
Dredging and Revetment Costs	
Mobilization	$21,220
Dredging	$7,151
Geotube Levee	$4,517
Excavation	$2,150
Rock	$86,231
Geofabric	$6,053
Mussel Survey	$5,000
Contingencies	$9,263
Real Estate Costs	$25,950
Plans and Specifications	$6,515
S & A During Construction	$6,515
Cost Subtotal	$180,565
Interest During Construction	$426
Gross Investment	$180,991

Sources: Ohio River Mainstream Ecosystem Restoration Project – Feasibility Report; Louisville District, USACE; and G.E.C., Inc.

3.2.2 Alternative 2. Big Bay Creek Embayment. The total estimated cost of Alternative 2 is $459,063 (Table 3-2). Activities included in these costs are equipment mobilization, riverbed evacuation, placement of rock revetments, placement of geofabric, and a mussel survey. Also included in the costs are contingencies, real estate costs, plans and specifications, supervision and administration during construction, and interest during construction. Interest during construction is based on the federal discount rate of 6.625 percent and a construction schedule of 44 days.

Table 3-2. Barren Creek and Big Bay Creek Embayments Project, Alternative 2, Big Bay Creek Embayment, Cost Estimate

Item	Costs
Embayment Costs	
Mobilization	$61,740
Excavation	$5,256
Rock	$241,949
Geofabric	$61,538
Mussel Survey	$5,000
Contingencies	$26,284
Real Estate Costs	$18,500
Plans and Specifications	$18,485
S & A During Construction	$18,485
Cost Subtotal	$457,237
Interest During Construction	$1,826
Gross Investment	$459,063

Sources: Ohio River Mainstream Ecosystem Restoration Project – Feasibility Report; Louisville District, USACE; and G.E.C., Inc.

3.2.3 Alternative 3. Dredge Channel Through Big Bay Creek Peninsula. The total estimated cost of implementing Alternative 3 is $530,244 (Table 3-3). Activities included in these costs are project management, equipment mobilization, excavating the channel, excavation for the rock revetment, placement of rock revetments, placement of geofabric, bank stabilization, reforestation of 23.5 acres, and a mussel survey. Other included costs are contingencies, real estate costs, plans and specifications, supervision and administration during construction, and interest during construction. Interest during construction is based on the federal discount rate of 6.625 percent and a construction schedule of 268 days.

3.3 Average Annual Cost

Table 3-4 presents a summary of the cost estimates for the three alternatives. The average annual cost of implementing each alternative, assuming a 50-year project life and a federal discount rate of 6.625 percent, is also presented. The average annual cost is the annual amount required to amortize the present value of project costs over the life of the project. It is equivalent to the annual payment needed to finance the project over 50 years at 6.625 percent interest.

The average annual cost of Alternative 1, Barren Creek Embayment, is $22,123. This includes an average annual cost of gross investment of $12,496 and average annual operation and maintenance costs of $9,627. The operation and maintenance costs are based on costs of $35,100 expected to be incurred every five years during the life of the project for maintenance dredging and $47,200 expected to be incurred every ten years during the life of the project for repair of rock revetments. These costs are discounted to their net present value, then amortized over the life of the project.

Table 3-3. Barren Creek and Big Bay Creek Embayments Project, Alternative 3, Dredge Channel Through Big Bay Creek Peninsula, Cost Estimate

Item	Costs
Dredging & Revetment Costs	
Project Management	$25,000
Mobilization	$61,740
Channel Excavation	$217,490
Revetement Excavation	$406
Rock Placement	$22,748
Geofabric	$9,806
Stabilize Channel	$4,096
Reforestation	$5,658
Mussel Survey	$5,000
Contingencies	$24,636
Real Estate Costs	$70,685
Plans and Specifications	$35,194
S & A During Construction	$35,194
Cost Subtotal	$517,654
Interest During Construction	$12,590
Gross Investment	$530,244

Sources. Ohio River Mainstream Ecosystem Restoration Project – Feasibility Report; Louisville District, USACE; and G.E.C., Inc.

Table 3-4. Barren Creek and Big Bay Creek Embayments Project, Summary of Construction and O & M Costs for Each Alternative

Item	Alternative 1	Alternative 2	Alternative 3
Gross Investment	$180,991	$459,063	$530,244
Annualized Gross Investment Cost	$12,496	$31,695	$36,610
Annualized O&M Costs	$9,627	$11,371	$2,310
Total Annualized Costs	$22,123	$43,066	$38,920

Sources: Ohio River Mainstream Ecosystem Restoration Project - Feasibility Report; Louisville District, USACE; and G.E.C., Inc.

The average annual cost of Alternative 2, Big Bay Creek Embayment, is $43,066. This includes an average annual cost of gross investment of $31,695 and average annual operation and maintenance costs of $11,371. The operation and maintenance costs are based on costs of $125,150 expected to be incurred for repair of bank protection and $29,200 for repair of rock revetments, for a total of $154,350 every 10 years during the life of the project. These costs are discounted to their net present value, then amortized over the life of the project.

The average annual cost of Alternative 3, Dredge Channel Through Big Bay Creek Peninsula, is $38,920. This includes an average annual cost of gross investment of $36,610 and average annual operation and maintenance costs of $2,310. The operation and maintenance costs are based on costs of $11,440 expected to be incurred for repair of the rock revetment and $19,917 expected to be incurred for repair of bank protection, for a total of $31,357 every 10 years during the life of the project. These costs are discounted to their net present value then amortized over the life of the project

3.4 Environmental Benefits

Environmental impacts associated with no-action and each alternative were measured in habitat acres. Because of resource and time constraints, field surveys could not be conducted to define the impact of each alternative. Therefore, environmental impacts were estimated using information provided in the feasibility report. Extensive field surveys would be required to more accurately quantify the environmental impacts of each alternative.

3.4.1. Alternative 1. Barren Creek Embayment. Over time, the mouth of Barren Creek has become clogged with sediments from the main Ohio River Channel, wave action from barge traffic, and sediments carried down the creek and deposited at the mouth of the creek. The proposed alternative would dredge the mouth of Barren Creek to restore depths of 9 to 12 feet. This increased depth would allow fishes to more freely access Barren Creek even during low flow periods. The dredge material will be placed on an adjacent site and dewatered. Further efforts to reduce sediment deposition and maintain the desired depth at the mouth of Barren Creek include the construction of a rock revetment and bank protection at the embayment mouth. The revetment would provide approximately 0.18 acre of submerged hard substrate at the mouth of the embayment to be utilized by a number of fishes and benthic invertebrates as velocity shelters, foraging habitat, and cover. Estimates of habitat acres created by the rock revetments are based on the total amount of surface area of the revetments. The increased velocity at the mouth of the creek will aid in maintaining the desired depth at the mouth. In addition, the increased velocity would increase the erosion of the banks at the mouth; therefore, the banks would be protected with rip-rap. This rip-rap would also decrease the erosion rate of the Ohio River banks.

3.4.2. Alternative 2. Big Bay Creek Embayment. The mouth of Big Bay Creek is presently being eroded by the Ohio River currents. This alternative calls for the construction of a rock revetment at the mouth of the creek to decrease the sedimentation rate and reduce the erosion of the banks. By constructing the revetment, the velocity of water from Big Bay Creek would increase, thereby creating scour holes along the rock revetment. The revetment alone would provide approximately 0.24 surface acre of submerged hard substrate to be utilized as velocity shelter, foraging habitat, and cover for a variety of fish and benthic invertebrate species. Estimates of habitat acres created by the rock revetments are based on the total amount of surface area of the revetments. In addition to the revetment, rip-rap would be placed along the banks of the Ohio River upstream of the confluence with Big Bay Creek and near the revetment to protect the banks from the currents of the Ohio River. The rip-rap would also ensure that the terrestrial/riparian habitat occurring along the river would not be destroyed through erosion.

3.4.3 Alternative 3. Dredge Channel Through Big Bay Creek Peninsula. In an attempt to better protect the mouth of Big Bay Creek, this alternative proposes to dredge a new channel through the upper end of a peninsula between Big Bay Creek and the main channel of the Ohio River. This channel would be constructed approximately 0.5 miles upstream of the mouth of Big Bay Creek and would be approximately 730 feet long and 80 feet wide at the water surface. In conjunction with the new channel, a diversion structure would be constructed to enhance the amount of flow entering into the new channel. This structure would measure 26 feet wide by 100 feet long at the base. The construction of the new channel and the diversion structure would create approximately 1.5 acres of submerged aquatic habitat. In addition, the diversion structure would provide velocity shelter and escape cover for a variety of aquatic organisms.

The new channel would change the narrow peninsula of farmland into an island of approximately 39 acres. This farmland on the island would be purchased, and approximately 60 percent of the property would be reforested with a mixture of mast-producing bottomland hardwood tree species. This island would provide approximately 23.5 acres of quality bottomland hardwood habitat for a variety of song birds and wildlife species. The remaining 15.5 acres of the island would be managed as open grasslands, which would provide foraging habitat for many song bird, game bird, and grazing wildlife species. All of these actions would increase recreational opportunities in the project area. Through placement of rip-rap along the main channel banks and at the mouth of the new channel, the created island would be further stabilized and protected against the normal currents and flood waters of the Ohio River. A total of 40.5 acres of habitat would be provided under this alternative.

3.4.4. Summary of Environmental Benefits

Under Alternative 1, Barren Creek Embayment, no-action results in no significant impacts, while implementing the alternative results in an average annual increase of 0.18 acre. For Alternative 2, Big Bay Creek Embayment, no- action results in no significant impacts, while implementing the alternative results in an average annual increase of 0.24 acre. Under Alternative 3, Dredge Channel Through Big Bay Creek Peninsula, no-action results in no significant impacts, while implementing the alternative results in an average annual increase of 40.5 acres.

3.5 Relationship Among Alternatives

Alternative 1 can be effectively combined with alternatives 2 or 3. However, alternatives 2 and 3 cannot be combined with each other because they seek to achieve the same goal of reducing sediment deposition in the mouth of Big Bay Creek. The costs and environmental outputs of the alternatives when combined are additive. IWR-PLAN requires that each alternative be assigned costs and outputs associated with both implementing and not implementing the alternative. The cost for not implementing an alternative (no-action) is $0. The environmental outputs associated with not implementing an alternative (no-action) are the quantity of habitat that would be impacted (lost) over the life of the project if the alternative is not implemented. These values are calculated in terms of average annual impacts, which are the cumulative number of acres impacted each year by the project divided by 50, the number of years the project will exist. The no-action outputs are entered into IWR-PLAN as negative values (lost habitat).

The cost of implementing each alternative is stated in average annual costs and includes construction costs and operation and maintenance costs. The environmental outputs associated with implementing

each alternative are calculated as the quantity of habitat created by the alternative and the quantity of habitat protected from loss if the alternative were not implemented (the no-action impacts). Because of the method that IWR-PLAN uses to combine alternatives to derive the various combinations of alternatives, the impacts associated with implementing the alternative must be entered into the program as net impacts. Net impacts for each alternative are calculated as the impacts associated with implementing the alternative minus the no-action impacts.

When developing the combination of alternatives, IWR-PLAN includes each alternative in the combination and assigns either an action or no-action status to each. For instance, the IWR-PLAN derived output from implementing Alternative 1 is actually calculated as the combination of the net impacts of the action of Alternative 1 (0.18 acre) and the no-action impacts of Alternative 2 (0 acre) and Alternative 3 (0 acre), resulting in a combined impact of 0.18 acre.

Including no-action, a total of six actual combinations of alternatives exist.

3.6 Cost Effectiveness Analysis

Cost effectiveness analysis is intended to illustrate which alternatives can produce the same amount of environmental output for less costs or a larger quantity of output for the same or less cost. Table 3-5 presents the average annual cost, annual environmental outputs, and average cost per output for each combination of alternatives. The cost-effective combinations are: No-Action, Alternative 1; Alternative 3; and the combination of alternatives 1 and 3. These combinations are presented in bold type in Table 3-5.

Table 3-5. Barren Creek and Big Bay Creek Embayments Project, Cost Effectiveness Analysis

Alternative	Outputs (Acres)	Costs ($1,000)	Average Cost ($/Acres)
No Action	**0.00**	**0.00**	**0**
Alternative 1	**0.18**	**22.12**	**122,889**
Alternative 2	0.24	43.06	179,417
Alternative 3	**40.50**	**38.92**	**961**
Alternatives 1 and 2	0.42	65.18	155,191
Alternatives 1 and 3	**40.68**	**61.04**	**1,501**

Source: G.E.C., Inc.

3.7 Incremental Cost Analysis

Incremental cost analysis illustrates the increase in costs associated with advancing from one output level to the next. Table 3-6 presents the average annual cost, the annual environmental output, the average cost of output, the incremental output, and the total and per unit incremental cost of the “best buy” alternatives.

Table 3-6. Barren Creek and Big Bay Creek Embayments Project, Incremental Cost Analysis of Increasing Output from the No-Action Alternative for the "Best Buy" Alternatives

Alternative	Outputs (Acres)	Costs ($1,000)	Average Cost ($/Acres)	Incremental Cost ($1,000)	Incremental Output (Acres)	Incremental Cost Per Output ($)
Alternative 3	40.50	38.92	961	38.92	40.50	961
Alternatives 1 and 3	40.68	61.04	1,501	22.12	0.18	122,889

Source: G.E.C., Inc.

Alternative 3 and the combination of alternatives 1 and 3 are considered "best buy" alternatives, or the alternatives that would generate the most output for any additional money expended. The average cost per habitat acre for Alternative 3 is $961, which is also the incremental cost per acre. A total of 40.5 beneficial habitat acres are produced under this combination. The total annual incremental cost, the increase in costs from No-Action, is $38,920.

The combination of alternatives 1 and 3 produces 40.68 beneficial habitat acres at an annual average cost of $61.04 resulting in an average cost of $1,501 per habitat acre. When compared to Alternative 3, the average annual incremental cost of this combination is $22,120, and the incremental output is 0.18 beneficial habitat acres, yielding a per unit incremental cost of $122,889.

Alternative 1 generates 0.18 average annual acre of habitat at an annual cost of $22,120. This equates to a cost of $122,889 ($22,120/0.18) per acre of output. Alternative 3 produces a total of 40.50 average annual acres at an annual cost of $38,920. This equates to a cost of $961 ($38,920/40.5) per acre of output. Alternative 3 produces more output at a lower per unit cost, making it a "better buy" than Alternative 1. In order to generate more than 40.5 acres of habitat, the cost-effective combination of alternatives 1 and 3 must be implemented. The combination of alternatives 1 and 3 produces a total of 40.68 acres, or 0.18 acres more than Alternative 3, at a total cost of $61,040, or $22,120 more than Alternative 3. This equates to a cost of $122,889 ($21,120/0.18) per additional acre of output over the 40.5 acres produced under Alternative 3. For these reasons, Alternative 3 and the combination of alternatives 1 and 3 are considered "best buy" plans.

4.0 SUMMARY AND CONCLUSION

This report presents an incremental analysis on the Barren Creek and Big Bay Creek Embayments Project, which is associated with a proposed ecosystem restoration program for the Ohio River. The Barren Creek and Big Bay Creek Embayment project is located in Pope County, Illinois, approximately 11.6 miles northeast of Paducah, Kentucky. The primary goal of the project is to provide shallow water and rock spawning habitat for fish and to restore and maintain the openings to the Barren Creek and Big Bay Creek embayments. Three alternatives were evaluated as part of the project and include: Alternative 1, Barren Creek Embayment; Alternative 2, Big Bay Creek Embayment; and Alternative 3, Dredge Channel Through Big Bay Creek Peninsula.

Under Alternative 1, Barren Creek Embayment, the opening for Barren Creek would be dredged and a rock revetment constructed. This alternative will reestablish a suitable depth for boater access and provide a suitable sub-grade for the rock revetment at the mouth, while the revetment will create habitat diversity for aquatic species such as fish and benthic invertebrates. Under Alternative 2, Big Bay Creek Embayment, a rock revetment will be constructed to protect the eroding riverbank and provide rock habitat within the project area. Under Alternative 3, Dredge Channel Through Big Bay Creek Peninsula, a channel between the main channel of the Ohio River and Big Bay Creek will be dredged. The resulting island could be replanted with preferred bottomland hardwoods. The primary benefits of this alternative would include increasing aquatic habitat, increasing terrestrial habitat due to land acquisition and habitat improvements (reforestation), and increasing recreational opportunities, especially fishing and hunting.

The following subsections provide a summary of impacts, as well as the cost effectiveness analysis.

4.1 Environmental Benefits

4.1.1. Alternative 1. Barren Creek Embayment. Dredging the opening for Barren Creek and constructing a rock revetment will create habitat diversity for aquatic species such as fish and benthic invertebrates. If this alternative is implemented, 0.18 acre of aquatic habitat will be created. There will be no direct loss of habitat for no-action under this alternative.

4.1.2. Alternative 2. Big Bay Creek Embayment. Constructing a rock revetment will protect the eroding riverbank and provide rock habitat within the project area. If this alternative is implemented, 0.24 acre of aquatic habitat will be created. There will be no direct loss of habitat for no-action under this alternative.

4.1.3. Alternative 3. Dredge Channel Through Big Bay Creek Peninsula . Dredging a channel between the main channel of the Ohio River and Big Bay Creek will create an island and could create aquatic habitat, increase terrestrial habitat due to land acquisition and habitat improvements (reforestation), and improve fishing and hunting. If this alternative is implemented, 40.5 acres of habitat will be created. There will be no significant direct loss of habitat for no-action under this alternative.

4.2 Cost Effectiveness and Incremental Cost Analysis

Cost effectiveness and incremental cost analyses were conducted for the combination of alternatives in order to provide decision-makers with information to choose the combination of alternatives that best satisfy project objectives. The environmental outputs of the alternatives were measured in habitat acres. Cost effectiveness analysis compared alternative plans that produces environmental outputs and determined which plan produces the largest quantity of output for a given cost, or produce the same or greater quantity of output for less cost. The cost-effective alternatives and combination of alternatives are: No-Action; Alternative 1; Alternative 3; and the combination of alternatives 1 and 3.

Incremental cost analysis compares the increase in costs (of cost-effective alternatives) of advancing from one output level to the next higher level of output to the increase in outputs. The resulting “best buy” alternatives are Alternative 3 and the combination of alternatives 1 and 3. The average cost per

habitat acre for Alternative 3 is $961, which is also the incremental cost per acre. A total of 40.5 beneficial habitat acres are produced under this combination. The total annual incremental cost, the increase in costs from No-Action, is $38,920. The combination of alternatives 1 and 3 produces 40.68 beneficial habitat acres at an average cost of $1,501 per habitat acre. When compared to Alternative 3, the average annual incremental cost of this combination is $22,120, and the incremental output is 0.18 beneficial habitat acres, yielding a per unit incremental cost of $122,889.

EXHIBIT H-4. EXAMPLE 3. UPPER T-DIKES, OHIO OH-06

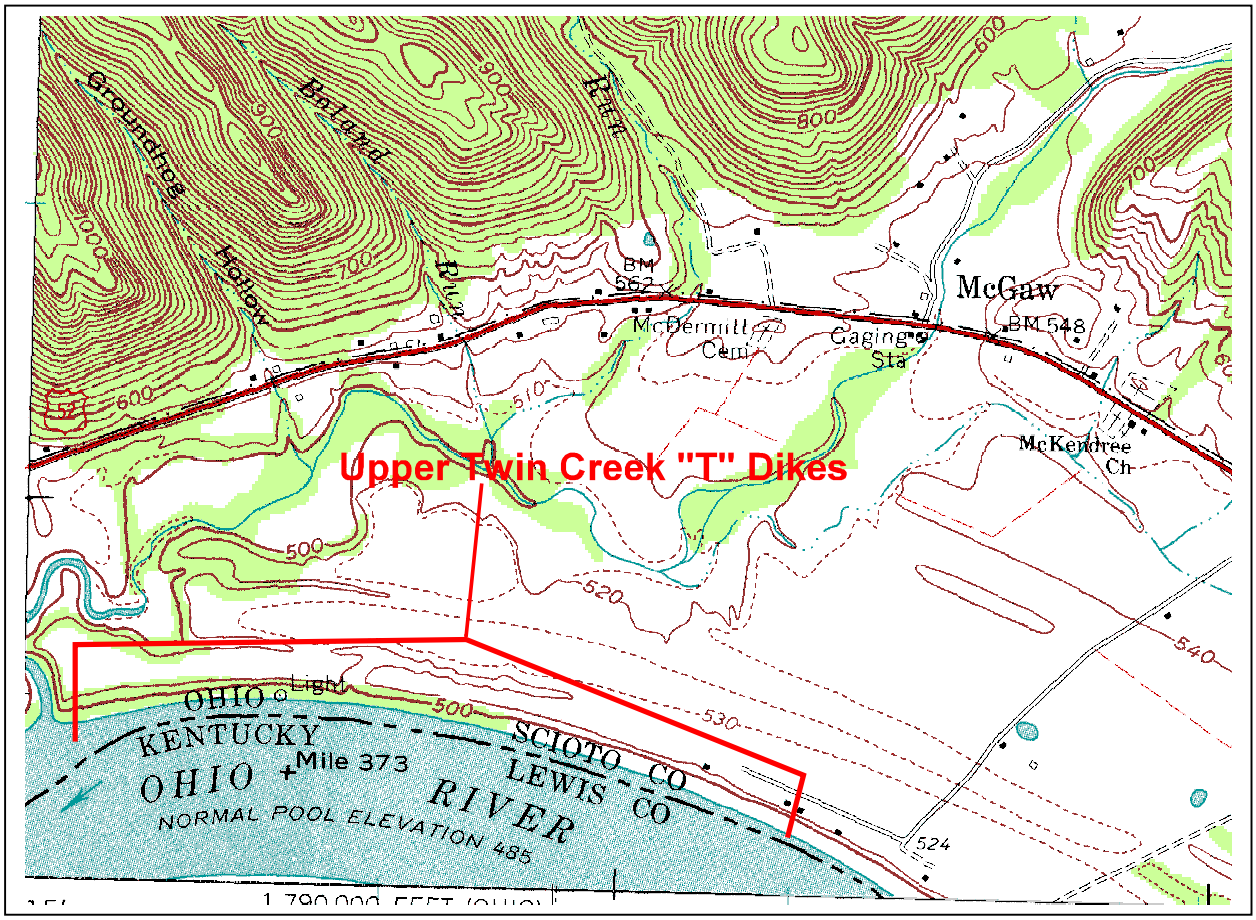
5.1 Description of Project and Impacts

5.2 Incremental Analysis

EXHIBIT H-4
5.1 UPPER TWIN CREEK "T" DIKES (OH-06)

1.0 Location

The proposed Upper Twin Creek "T" Dikes project area is located in Scioto County, Ohio approximately 14.5 miles southwest of Portsmouth, Ohio. The project site is in the Ohio River Meldahl Pool between Ohio River Mile (ORM) 372 and 373. The project site is within the jurisdiction of the Huntington District, U.S. Army Corps of Engineers (USACE).



2.0 Project Goal

The primary goals of the Upper Twin Creek "T" Dikes project are to provide aquatic habitat diversity upstream from Upper Twin Creek and to provide velocity shelters for fishes in the Ohio River during winter and times of high flows. Increased habitat diversity would correlate with a sustained fishery resource.

3.0 Project Description and Rationale

A group of ten "T" shaped boulder (rip-rap) structures will be created upstream from Upper Twin Creek along the main channel border of the Ohio River. The boulder piles will be constructed at various depths and at various distances from the shoreline outside of the navigation channel to maximize habitat heterogeneity. The "T" dikes structures will also provide velocity shelters for fishes during all seasons.

4.0 Existing Conditions

Terrestrial/Riparian Habitat: The Ohio bank of the Ohio River east of the mouth of Upper Twin Creek is dominated by a band of riparian trees. The dominant species present in the stand include box elder (*Acer negundo*), black willow (*Salix nigra*), and silver maple (*Acer saccharinum)*. The area appears to be highly disturbed, and the shoreline area is littered with trash including hundreds of discarded tires.

Aquatic Habitats: The proposed location of Upper Twin Creek "T" Dikes is east of the mouth of Upper Twin Creek along the Ohio bank of the Ohio River between ORM 372 and 373. The proposed location is on an outside bend of the Ohio River off of the main navigation channel. There is currently minimal structure or habitat diversity in the location where the series of "T" dike structures would be positioned. The banks are characterized by mud/sand, and the bottom substrates are composed primarily of silt and fine sand.

A narrow littoral zone extends from the shoreline to approximately 3 yards from the bank before gradually dropping to an average depth of 12-14 feet at approximately 25 yards from the bank. At approximately 50 yards from the bank the average depth is approximately 15-20 feet deep.

Wetlands: There are no jurisdictional wetlands present in the immediate vicinity of the proposed Upper Twin Creek "T" Dikes project area. Wetlands in the vicinity of the project would be restricted to the bottomland hardwoods associated with the riparian zone adjacent to the Ohio River.

Federally-Listed Threatened and Endangered Species: According to the U.S. Fish and Wildlife Service (USFWS), there are three federally-listed threatened and endangered species known to occur in Scioto County, Ohio. These species are shown on Table 1.

Table 1. Federally-listed species known to occur in Scioto County, Ohio.

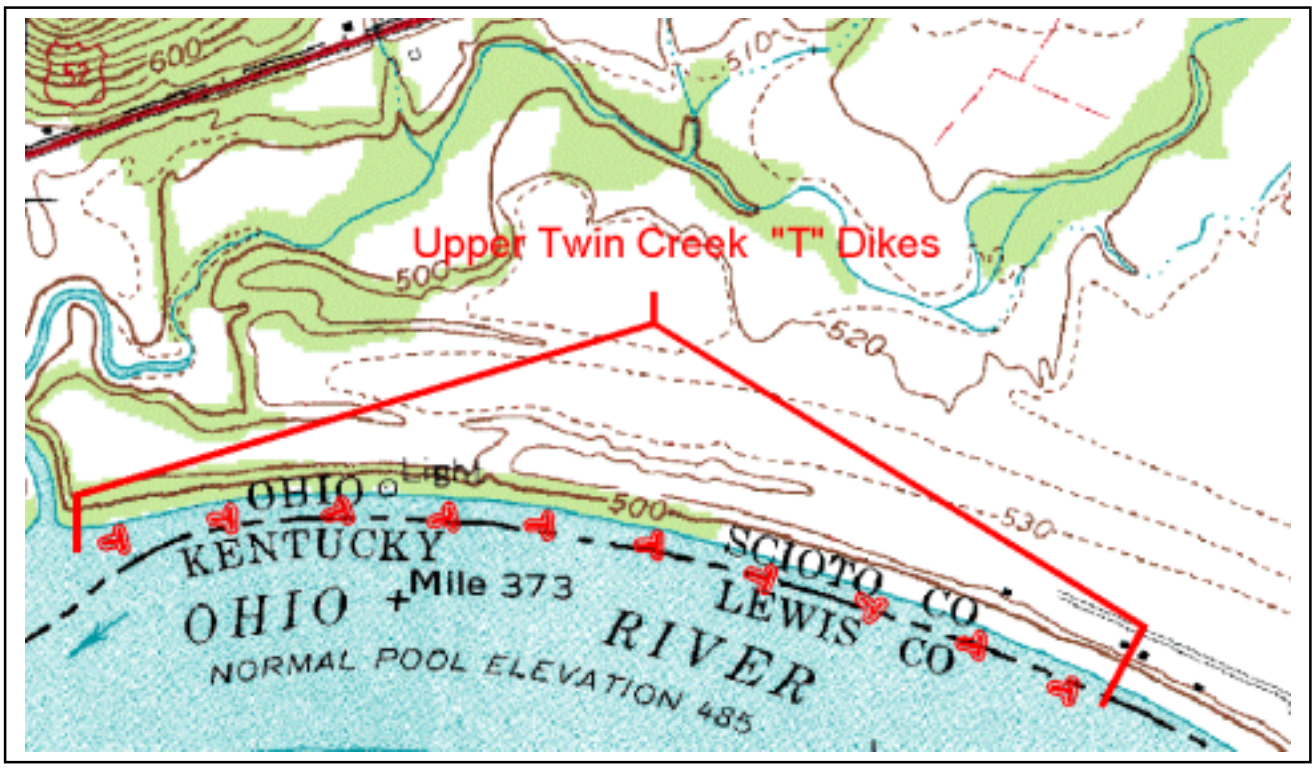
Common Name	Scientific Name	Federal Status	Potential Habitat Present
Indiana bat	*Myotis sodalis*	Endangered	no
Virginia spiraea	*Spirea virginiana*	Threatened	no
small whorled pogonia	*Isotria medeoloides*	Threatened	no

Source: Parsons Engineering Science, 2000

Upper Twin Creek “T” Dikes upstream.

Upper Twin Creek “T” Dikes downstream.

5.0 Project Diagram



6.0 Engineering Design and Requirements

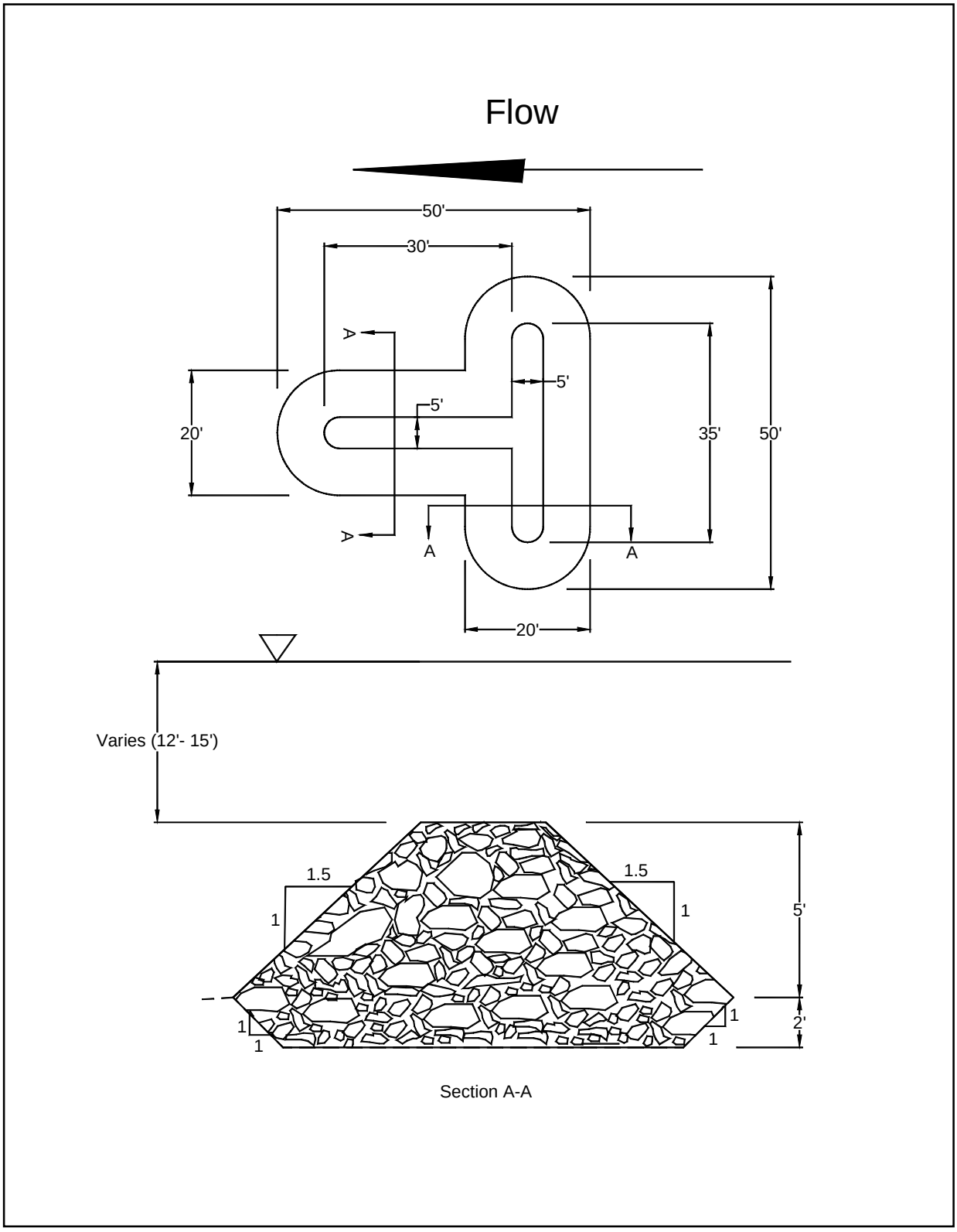
6.1 Existing Ecological/Engineering Concern

The Ohio River channel upstream from the mouth of Upper Twin Creek has very little habitat diversity. Since this area is on an outside bend of the river, river currents limit the natural deposition of structure, such as snags. The creation of the proposed "T" dikes would provide a complex structure that would increase submerged habitat. In addition to the added hard substrate, the altered bathymetry associated with changes in water flow would also enhance habitat diversity.

6.2 "T" Dike Structure

A "T" Dike is a large rock revetment designed to provide submerged aquatic habitat. These structures would be placed in a field of ten. Each structure would be randomly positioned, 25 to 50 yards from the riverbank, between ORM 372 and 373. An individual structure would be 35 feet in width and 30 feet in length at the top (Figure 1). The structure would have 1.5 to 1 side slopes, and the overall dimension would be 50 feet by 50 feet. The dike shall be toed into the sub-grade a minimum of 2 feet and stand above the channel bottom approximately 5 feet. The size of the rock used shall be uniformly graded limestone with each rock weighing between 50 and 150 pounds. Normally a well-graded rock would be used, however, a uniform gradation would provide better aquatic habitat.

Figure 1. “T” Dike detail.



7.0 Planning/Engineering Assumptions

"T" Dike Structure

- Average channel velocities are 3 feet per second.
- All rip-rap material would be shipped by barge to the project site. All costs for shipping are included in the material costs.
- Excavated material from site preparation can be disposed of into the main river channel.

8.0 Cost Estimate (Construction)

"T" Dike Structure - Construction costs for the proposed project are contained on Table 2. A detailed MCACES cost estimate for the proposed project **will** be included in Appendix D at a later date.

Table 2. Construction Costs.	
Item	**Cost**
Excavation ($1,200 Each)	$12,000
"T" Dike Revetment ($7,500 Each)	$75,000
Mobilization and Contingencies @ 20%	$17,400
TOTAL	**$104,400**

9.0 Schedule:

Upper Twin Creek "T" Dikes: The estimated construction time for this project is shown on Table 3.

Table 3. Construction Schedule.	
Item	**Time**
Mobilization	2 Days
Excavation	8 Days
"T" Dike Revetment	45 Days
TOTAL	**55 Days**

10.0 Expected Ecological Benefits

Terrestrial/Riparian Habitat: The Upper Twin Creek "T" Dikes project would be constructed in-stream adjacent to the Ohio bank of the Ohio River. Since all of the proposed construction would be in-stream, there would be no reasonably foreseeable beneficial impacts to terrestrial/riparian resources.

Aquatic Habitats: Long-term beneficial impacts to aquatic resources would be anticipated as a result of constructing the Upper Twin Creek "T" Dikes. The complex structure of the rip-rap "T" dike coupled with localized changes in flow patterns and the scouring effects downstream from the rock revetments would lead to improved habitat diversity for aquatic species. Habitat requirements for fishes change seasonally. The "T" dike structure and the changes in bathymetry associated with the altered water flow from the structure would provide velocity shelters during the winter and during times of high flows.

An improved fishery could also have benefits on mussel populations in and near the project area. Most of the mussels found in the Ohio River require fish hosts to complete their larval life stage. Increased numbers of potential host fish would likely increase the number of larvae successfully completing the metamorphosis from larvae to juvenile mussels. Movement of these fish between habitats may also provide a means of dispersal for the juvenile mussels.

The addition of the hard substrate (rip-rap) would result in long-term beneficial impacts to other aquatic species, especially benthic macroinvertebrates, due to the increase in the habitat diversity. The rip-rap "T" dike would provide more silt-free submerged surface area for invertebrates as well as foraging and escape cover for various invertebrates and small fishes.

Wetlands: There would be no reasonably foreseeable beneficial impacts to jurisdictional wetlands as a result of constructing the Upper Twin Creek "T" Dikes.

Federally-Listed Threatened and Endangered Species: There would be no reasonably foreseeable beneficial impacts to Indiana bats, Virginia spiraea, or small whorled pogonia as a result of constructing the Upper Twin Creek "T" Dikes.

Although no federally-listed mussel species have been documented in the vicinity of the project area or in Scioto County, there are several endangered mussel known to occur in the Ohio River. The complex nature of the rip-rap structure from the "T" dikes coupled with localized changes in flow patterns and the scouring effects downstream from the structure could lead to improved habitat for endangered mussels and similar species. Also, as mentioned above, an improved fishery may also benefit mussel populations through increased numbers of potential hosts and means of dispersal.

Socioeconomic Resources: There would be short-term and long-term beneficial impacts to socioeconomic resources as a result of implementing the proposed project. The short-term beneficial impacts would be related to costs and local expenditures associated with the construction of the "T" dikes.

Potential Adverse Environmental Impacts

Terrestrial/Riparian Habitat: During the site preparation and construction of the revetments, there would be a potential for short-term adverse impacts to terrestrial species from construction-related noise and disturbance. Considering the existing high volume of disturbance from barge traffic along the Ohio River and recreational boat usage in the area, it is likely that the increased noise/disturbance impacts would be very minor.

Aquatic Habitats: There would be a potential for adverse affects to aquatic species, especially immobile benthic invertebrates during the construction of the Upper Twin Creek "T" Dikes. Localized populations of benthic invertebrates could be covered with rip-rap during the construction of the "T" dikes. In addition, sensitive aquatic species immediately downstream from the site could be adversely impacted by degraded water quality associated with displaced sediments, especially during the site preparation/excavation. The adverse impacts to aquatic species would be short term, and the overall beneficial impacts of the restoration project would outweigh the adverse impacts.

Wetlands: There would be no adverse affects to jurisdictional wetlands as a result of constructing the Upper Twin Creek "T" Dikes.

Federally-Listed Threatened and Endangered Species: It would be unlikely that the Indiana bat, Virginia spiraea, or small whorled pogonia would be adversely affected by the construction of the proposed project.

Socioeconomic Resources: There would be no reasonably foreseeable adverse socioeconomic impacts as a result of implementing the proposed project.

11.0 Mitigation

Minor impacts associated with site preparation/excavation and rock (rip-rap) placement may occur during the construction of this project, however, no significant adverse impacts are expected. The use of best management practices and proper construction techniques would minimize adverse water quality impacts. No substantial mitigation measures would be necessary to complete this project.

12.0 Preliminary Operation and Maintenance Costs:

Upper Twin Creek "T" Dikes Operation and Maintenance costs are summarized on Table 4.

Table 4. Operation and Maintenance Costs (50 Year Life)		
Maintenance	**Frequency**	**Costs**
Repair of Rock Structures	10 years	$52,200

13.0 Potential Cost Share Sponsor(s)

- State of Ohio
- local fishing groups/tournament fishermen
- barge/towing industry
- U.S. Fish & Wildlife Service

14.0 Expected Life of the Project

It is anticipated that the "T" dike structures would have an intact life expectancy of 50 years.

15.0 Hazardous, Toxic, and Radiological Waste Considerations

Potential impacts of hazardous, toxic, and radiological waste (HTRW) at the site were visually assessed during a site visit and further assessed via a database search of HTRW records in the site area.

Site Inspection Findings. The project site is located in the Ohio River immediately upstream of the mouth of Upper Twin Creek in Scioto County, Ohio.

The following environmental conditions were considered when conducting the June 9, 1999 project area inspection:

- Suspicious/Unusual Odors;
- Discolored Soil;
- Distressed Vegetation;
- Dirt/Debris Mounds;
- Ground Depressions;
- Oil Staining;
- Above Ground Storage Tanks (ASTs);
- Underground Storage Tanks (USTs);
- Landfills/Wastepiles;
- Impoundments/Lagoons;
- Drum/Container Storage;
- Electrical Transformers;
- Standpipes/Vent pipes;
- Surface Water Discharges;
- Power or Pipelines;
- Mining/Logging; and
- Other

Sparse residential houses and hardwood forest are to the north of the project area. None of the environmental conditions listed above were observed in the project area.

Risk Management Data Search. A search of available environmental records was conducted by Environmental Data Resources, Inc. (EDR). The search complied with ASTM Standard Practice for Environmental Site Assessments, E 1527-97. The search report with maps showing the search area around the project site is presented in Appendix B. The search distance was configured to include the area of the project and a buffer zone beyond the boundary of the project. It was conservatively assumed that any environmental conditions beyond the project area buffer zone would not impact the project. Databases searched and the distance searched from the project site for each environmental item (e.g., USTs, NPL sites, etc.) are as follows:

Databases	Search Radius (Miles)
NPL: National Priority List	1.75
RCRIS-TSD: Resource Conservation and Recovery Information System	1.25
SHWS: State Hazardous Waste Sites	1.75
CERCLIS: Comprehensive Environmental Response, Compensation, and Liability Information System	1.25
CORRACTS: Corrective Action Report	1.75
SWF/LF: Available Disposal for Solid Waste in Illinois- Solid Waste Landfills Subject to State Surcharge	1.25
LUST: Leaking Underground Storage Tank	Not Applicable for This Site
UST: Underground Storage Tank	1.00
RCRIS-SQG: Resource Conservation and Recovery Information System for Small Quantity Generators	1.00
RCRIS-LQG: Resource Conservation and Recovery Information System for Large Quantity Generators	1.00
ROD: Record of Decision	1.75
CONSENT: Superfund (CERCLA) Consent Decrees	1.75
Coal Gas: Former Manufactured gas (Coal Gas) Sites	1.00
MINES: Mines Master Index File	1.00

HTRW Findings and Conclusions

An inspection of the project site and a search of environmental records relevant to the project site and extended areas beyond have revealed no evidence of recognized environmental problem conditions in connection with this project site.

APPENDIX A Threatened & Endangered Species

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Ecological Services
6950 Americana Parkway, Suite H
Reynoldsburg, Ohio 43068-4132

Voice: 614-469-6923 / Fax: -6919

FEDERALLY ENDANGERED, THREATENED & PROPOSED SPECIES; OHIO
July 8, 1998

NAME/STATUS	COUNTIES OF CURRENT, RECENT (c. 25 years) AND POSSIBLE DISTRIBUTION
Indiana bat (E) *Myotis sodalis*	Adams, Allen, Ashland, Ashtabula, Athens, Auglaize, Brown, Butler, Carroll, Champaign, Clark, Clermont(M), Clinton, Columbiana, Coshocton, Crawford, Cuyahoga, Darke, Defiance, Delaware, Erie, Fairfield, Fayette, Franklin, Fulton, Gallia, Geauga, Greene, Guernsey, Hamilton(M), Hancock, Hardin, Henry, Highland, Hocking (M), Holmes, Huron, Jackson, Knox, Lake, Lawrence, Licking, Logan, Lorain, Lucas, Madison, Mahoning, Marion, Medina, Mercer, Miami, Montgomery, Morrow, Muskingum, Ottawa, Paulding, Perry, Pickaway, Pike, Portage, Preble(H), Putnam, Richland, Ross, Sandusky, Scioto, Seneca, Shelby, Stark, Summit, Trumbull, Tuscarawas, Union, Van Wert, Vinton, Warren(M), Wayne, Williams, Wood, Wyandot
Bald eagle (T) *Haliaeetus leucocephalus*	Ashtabula(N), Delaware(N), Coshocton(N), Erie(N&W), Geauga(N), Hamilton(W), Hocking(N), Holmes, Huron(N), Knox(N), Lake, Licking, Lorain, Lucas(N&W), Mahoning(N), Mercer(N), Muskingum(N), Ottawa(N&W), Portage(N), Sandusky(N&W), Seneca(N), Stark(N), Summit, Trumbull(N), Wood (N), Wyandot(N)
Peregrine falcon (E) *Falco peregrinus*	Cuyahoga(N), Franklin(N), Hamilton(N), Lorain(N), Lucas(N), Montgomery(N), Summit(N)
Piping plover (E) *Charadrius melodus*	Cuyahoga, Lucas, Ottawa, Sandusky, Erie, Lorain, Lake, Ashtabula
Scioto madtom (E) *Noturus trautmani*	Franklin, Madison, Pickaway, Union
Purple cat's paw pearly mussel (E) *Epioblasma obliquata obliquata*	Coshocton

Northern rifffleshell (E) Epioblasma torulosa rangiana	Franklin, Madison, Pickaway, Williams
Fanshell (E) Cyprogenia stegaria (=C. irrorata)	Coshocton, Morgan, Washington
Clubshell mussel (E) Pleurobema clava	Adams, Ashtabula, Coshocton, Defiance, Delaware, Fairfield, Franklin, Greene, Hancock, Madison, Pickaway, Trumbull, Tuscarawas, Union, Williams
White cat's paw pearly mussel (E) Epioblasma obliquata perobliqua	Williams
Pink mucket pearly mussel (E) Lampsilis abrupta (= L. orbiculata)	Gallia, Morgan, Washington, Lawrence, Meigs
American burying beetle (E) Nicrophorus americanus	Athens, Hocking, Vinton
Mitchell's satyr (E) Neonympha mitchellii mitchellii	Portage
Karner blue (E) Lycaeides melissa samuelis	Lucas
Running buffalo clover (E) Trifolium stoloniferum	Clermont, Hamilton, Lawrence, Warren
Lakeside daisy (T) Hymenoxys herbacea (Formerly H. acaulis var. glabra)	Erie, Ottawa
Northern monkshood (T) Aconitum noveboracense	Hocking, Portage, Summit
Eastern prairie fringed orchid (T) Platanthera leucophaea	Clark, Holmes, Lucas, Ottawa, Sandusky, Wayne
Virginia spirsea (T) Spiraea virginiana	Scioto

Small whorled pogonia (T) Isotria medeoloides	Scioto
Lake Erie water snake (PT) Nerodia sipedon insularum	Ottawa, Erie
Copperbelly water snake (T) Nerodia erythrogaster neglecta	Defiance, Hardin, Williams

STATUS CODES:

E = Endangered
T = Threatened
PE = Proposed to be listed as Federally endangered
PT = Proposed to be listed as Federally threatened

N = Nest site (eagles/peregrine falcons)
H = Hack site (peregrine falcons)
W = Winter use site (eagles)

M = Summer maternity colony located in the county (Indiana bat)
H = Winter hibernacula located in the county (Indiana bat)

Small whorled pogonia (T) Isotria medeoloides	Scioto
Lake Erie water snake (PT) Nerodia sipedon insularum	Ottawa, Erie
Copperbelly water snake (T) Nerodia erythrogaster neglecta	Defiance, Hardin, Williams

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United States Department of the Interior

FISH AND WILDLIFE SERVICE

Ecological Services
6950 Americana Parkway, Suite H
Reynoldsburg, Ohio 43068-4132

Federally Listed Species by Ohio Counties
July 8, 1998

E = Endangered
T = Threatened
PT = Proposed threatened

County	Species
ADAMS	Indiana bat (E), clubshell mussel (E)
ALLEN	Indiana bat (E)
ASHLAND	Indiana bat (E)
ASHTABULA	Indiana bat (E), bald eagle (T), clubshell mussel (E), piping plover (E)
ATHENS	American burying beetle (E), Indiana bat (E)
AUGLAIZE	Indiana bat (E)
BELMONT	
BROWN	Indiana bat (E)
BUTLER	Indiana bat (E)
CARROLL	Indiana bat (E)
CHAMPAIGN	Indiana bat (E)
CLARK	Indiana bat (E), eastern prairie fringed orchid (T)
CLERMONT	Indiana bat (E), running buffalo clover (E)
CLINTON	Indiana bat (E)
COLUMBIANA	Indiana bat (E)
COSHOCTON	clubshell mussel (E), fanshell mussel (E), purple cat's paw pearly mussel (E), bald eagle (T), Indiana bat (E)
CRAWFORD	Indiana bat (E)

CUYAHOGA	Indiana bat (E), peregrine falcon (E), piping plover (E)
DARKE	Indiana bat (E)
DEFIANCE	Indiana bat (E), copperbelly water snake (T), clubshell mussel (E)
DELAWARE	Indiana bat (E), clubshell mussel (E), bald eagle (T)
ERIE	Indiana bat (E), bald eagle (T), Lake Erie water snake (PT), lakeside daisy (T), piping plover (E)
FAIRFIELD	Indiana bat (E), clubshell mussel (E)
FAYETTE	Indiana bat (E)
FRANKLIN	Indiana bat (E), peregrine falcon (E), Scioto madtom (E), clubshell mussel (E), northern riffleshell mussel (E)
FULTON	Indiana bat (E)
GALLIA	Indiana bat (E), pink mucket pearly mussel (E)
GEAUGA	Indiana bat (E), bald eagle (T)
GREENE	Indiana bat (E), clubshell (E)
GUERNSEY	Indiana bat (E)
HAMILTON	Indiana bat (E), bald eagle (T), peregrine falcon (E), running buffalo clover (E)
HANCOCK	Indiana bat (E), clubshell (E)
HARDIN	Indiana bat (E), copperbelly water snake (T)
HARRISON	
HENRY	Indiana bat (E)
HIGHLAND	Indiana bat (E)
HOCKING	Indiana bat (E), northern monkshood (T), bald eagle (T), American burying beetle (E)
HOLMES	Indiana bat (E), bald eagle (T), eastern prairie fringed orchid (T)
HURON	Indiana bat (E), bald eagle (T)
JACKSON	Indiana bat (E)
JEFFERSON	
KNOX	Indiana bat (E), bald eagle (T)

LAKE	Indiana bat (E), bald eagle (T), piping plover (E)
LAWRENCE	pink mucket pearly mussel (E), running buffalo clover (E), Indiana bat (E)
LICKING	Indiana bat (E), bald eagle (T)
LOGAN	Indiana bat (E)
LORAIN	Indiana bat (E), bald eagle (T), peregrine falcon (E), piping plover (E)
LUCAS	Indiana bat (E), bald eagle (T), peregrine falcon (E), Karner blue butterfly (E), eastern prairie fringed orchid (T), piping plover (E)
MADISON	Indiana bat (E), Scioto madtom (E), clubshell mussel (E), northern riffleshell mussel (E)
MAHONING	Indiana bat (E), bald eagle (T)
MARION	Indiana bat (E)
MEDINA	Indiana bat (E)
MEIGS	pink mucket pearly mussel (E)
MERCER	Indiana bat (E), bald eagle (T)
MIAMI	Indiana bat (E)
MONROE	
MONTGOMERY	Indiana bat (E), peregrine falcon (E)
MORGAN	fanshell mussel (E), pink mucket pearly mussel (E)
MORROW	Indiana bat (E)
MUSKINGUM	bald eagle (T), Indiana bat (E)
NOBLE	
OTTAWA	Indiana bat (E), bald eagle (T), Lake Erie water snake (PT), eastern prairie fringed orchid (T), lakeside daisy (T), piping plover (E)
PAULDING	Indiana bat (E)
PERRY	Indiana bat (E)
PICKAWAY	Indiana bat (E), Scioto madtom (E), clubshell mussel (E), northern riffleshell mussel (E)

PIKE	Indiana bat (E)
PORTAGE	Indiana bat (E), bald eagle (T), Mitchell's satyr butterfly (E), northern monkshood (T)
PREBLE	Indiana bat (E)
PUTNAM	Indiana bat (E)
RICHLAND	Indiana bat (E)
ROSS	Indiana bat (E)
SANDUSKY	Indiana bat (E), bald eagle (T), piping plover (E), eastern prairie fringed orchid (T)
SCIOTO	Indiana bat (E), Virginia spiraea (T), small whorled pogonia (T)
SENECA	Indiana bat (E), bald eagle (T)
SHELBY	Indiana bat (E)
STARK	Indiana bat (E), bald eagle (T)
SUMMIT	Indiana bat (E), bald eagle (T), peregrine falcon (E), northern monkshood (T)
TRUMBULL	Indiana bat (E), bald eagle (T), clubshell mussel (E)
TUSCARAWAS	clubshell mussel (E), Indiana bat (E)
UNION	Indiana bat (E), Scioto madtom (E), clubshell mussel (E)
VAN WERT	Indiana bat (E)
VINTON	American burying beetle (E), Indiana bat (E)
WARREN	Indiana bat (E), running buffalo clover (E)
WASHINGTON	fanshell mussel (E), pink mucket pearly mussel (E)
WAYNE	Indiana bat (E), eastern prairie fringed orchid (T)
WILLIAMS	Indiana bat (E), copperbelly water snake (T), clubshell mussel (E), northern riffleshell mussel (E), white cat's paw pearly mussel (E)
WOOD	Indiana bat (E), bald eagle (T)
WYANDOT	Indiana bat (E), bald eagle (T)

APPENDIX B Hazardous Toxic and Radiological Wastes

Environmental Data Resources, Inc.
an edr company

The EDR-Radius Map
with GeoCheck®

OHIO (OH-06)
UPPER TWIN CREEK "T" DIKES
HABITAT RESTORATION
RIVER MILE 373.2-372

Inquiry Number: 383891.1s

June 24, 1999

The Source For Environmental Risk Management Data

3530 Post Road
Southport, Connecticut 06490

Nationwide Customer Service

Telephone: 1-800-352-0050
Fax: 1-800-231-6802
Internet: www.edrnet.com

TABLE OF CONTENTS

SECTION PAGE

APPENDICES

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

EXECUTIVE SUMMARY

A search of available environmental records was conducted by Environmental Data Resources, Inc. (EDR). The report meets the government records search requirements of ASTM Standard Practice for Environmental Site Assessments, E 1527-97. Search distances are per ASTM standard or custom distances requested by the user.

The address of the subject property for which the search was intended is:

OH-08, RIVER MILE 373.2-372
GARRISON, KY 41141

No mapped sites were found in EDR's search of available ("reasonably ascertainable ") government records either on the subject property or within the ASTM E 1527-97 search radius around the subject property for the following Databases:

NPL:	National Priority List
Delisted NPL:	NPL Deletions
RCRIS-TSD:	Resource Conservation and Recovery Information System
SHWS:	State Haz. Waste
CERCLIS:	Comprehensive Environmental Response, Compensation, and Liability Information System
CERC-NFRAP:	Comprehensive Environmental Response, Compensation, and Liability Information System
CORRACTS:	Corrective Action Report
SWF/LF:	Solid Waste Facilities List
UST:	Underground Storage Tank Database
RAATS:	RCRA Administrative Action Tracking System
RCRIS-SQG:	Resource Conservation and Recovery Information System
RCRIS-LQG:	Resource Conservation and Recovery Information System
HMIRS:	Hazardous Materials Information Reporting System
PADS:	PCB Activity Database System
ERNS:	Emergency Response Notification System
FINDS:	Facility Index System/Facility Identification Initiative Program Summary Report
TRIS:	Toxic Chemical Release Inventory System
NPL Lien:	NPL Liens
TSCA:	Toxic Substances Control Act
MLTS:	Material Licensing Tracking System
ROD:	ROD
CONSENT:	Superfund (CERCLA) Consent Decrees
MINES:	Mines Master Index File

Unmapped (orphan) sites are not considered in the foregoing analysis.

Search Results:

Search results for the subject property and the search radius, are listed below:

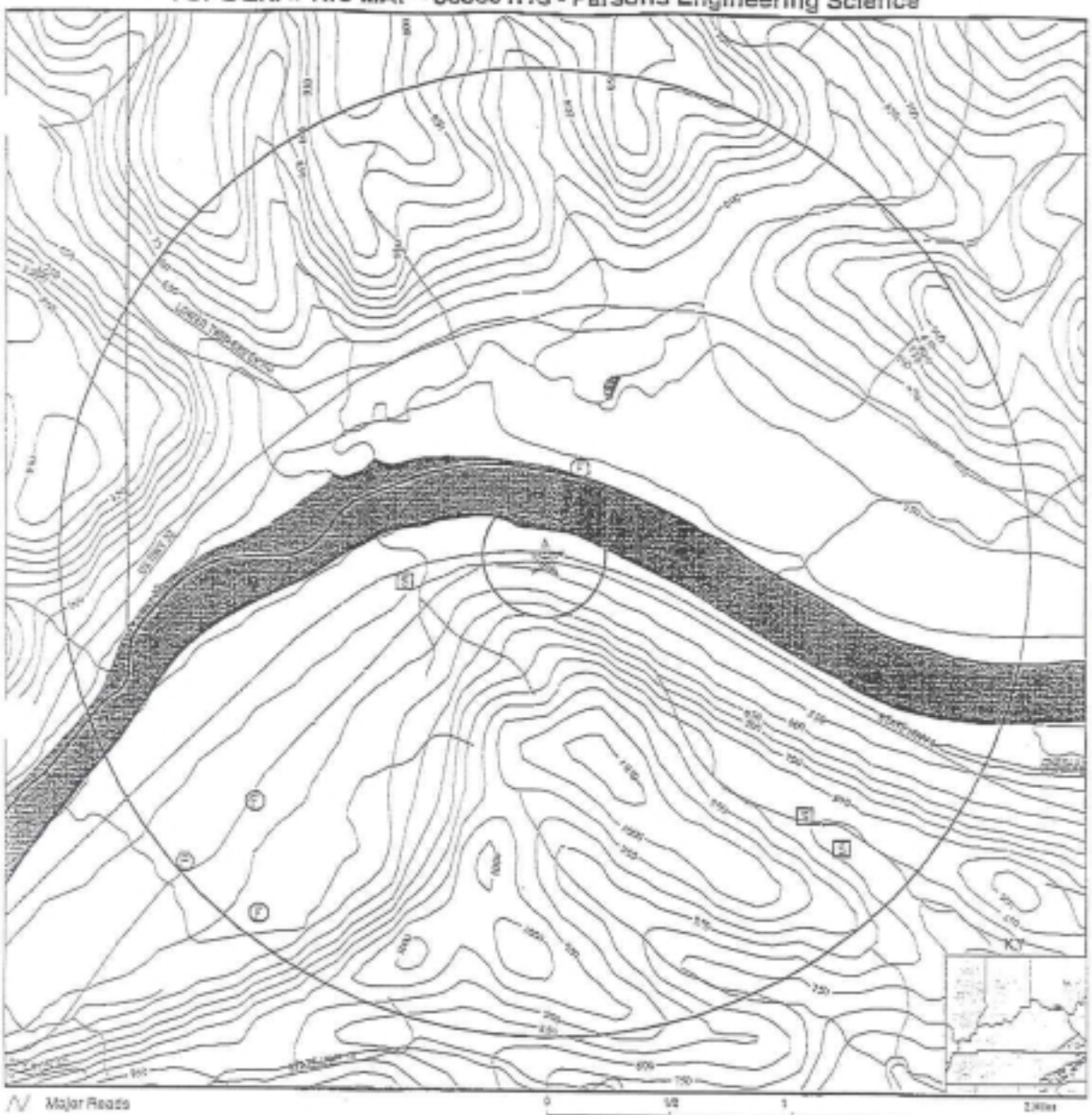
Subject Property:

The subject property was not listed in any of the databases searched by EDR.

Due to poor or inadequate address information, the following sites were not mapped:

Site Name	Database(s)
VICS GROCERY	LUST
BUENA VISTA GENERAL STORE	LUST
MARATHON MARINA MART	LUST
GARRISON ELEMENTARY SCHOOL	UST
GR5 FULL SERVICE GAS	UST
GARRISON BP INC	UST
DOUBLE A TRUCK STOP	UST
BENTLEY BROTHERS MARKET	UST
MP 547.38 LEWIS COUNTY	RCRIS-SQG,FINDS
TYLERS GAS	RCRIS-SQG,FINDS

TOPOGRAPHIC MAP - 383891.1s - Parsons Engineering Science



TARGET PROPERTY:	OH-06, River Mile 373.2-372	CUSTOMER:	Parsons Engineering Science
ADDRESS:	OH-06, River Mile 373.2-372	CONTACT:	Mr. Bruce Cox
CITY/STATE/ZIP:	Garrison KY 41141	INQUIRY #:	383891.1s
LAT/LONG:	38.6230 / 83.2356	DATE:	June 24, 1999 10:36 am

GEOCHECK VERSION 2.1 SUMMARY

TARGET PROPERTY COORDINATES

Latitude (North):	38.629032 - 38° 37' 22.8"
Longitude (West):	83.236550 - 83° 14' 11.7"
Universal Transverse Mercator:	Zone 17
UTM X (Meters):	305291.2
UTM Y (Meters):	4277111.0

USGS TOPOGRAPHIC MAP ASSOCIATED WITH THIS SITE

Target Property:	2438083-E2 GARRISON, KY OH

GEOLOGIC AGE IDENTIFICATION†

Geologic Code:	D3
Era:	Paleozoic
System:	Devonian
Series:	Upper Devonian

ROCK STRATIGRAPHIC UNIT†

Category:	Stratified Sequence

GROUNDWATER FLOW INFORMATION

Groundwater flow direction for a particular site is best determined by a qualified environmental professional using site-specific well data. If such data is not reasonably ascertainable, it may be necessary to rely on other sources of information, including well data collected on nearby properties, regional groundwater flow information (from deep aquifers), or surface topography.‡

AQUIFLOW™ Search Radius: 2.000 Miles

MAP ID	DISTANCE FROM TP	DIRECTION FROM TP	GENERAL DIRECTION GROUNDWATER FLOW
Not Reported			

General Topographic Gradient at Target Property: General North

General Hydrogeologic Gradient at Target Property: The hydrogeologic gradient for this report has been determined using the depth to water table information provided below. Where available, the closest well in each quadrant has been identified (up to a radius of 5 miles around the target property) and used in the gradient calculation. While an attempt has been made to segregate shallow from deep aquifers, this cannot always be assured. Groundwater flow in the aquifer associated with the wells appears generally to be to the North.

FEDERAL DATABASE WELL INFORMATION

WELL QUADRANT	DISTANCE FROM TP	LITHOLOGY	DEPTH TO WATER TABLE
Northern	1/4 - 1/2 Mile	Glacial (undifferentiated)	38 ft.
Eastern	>2 Miles	Not Reported	48 ft.
Southern	1 - 2 Miles	Not Reported	Not Reported
Western	1 - 2 Miles	Alluvium	95 ft.

STATE DATABASE WELL INFORMATION

WELL QUADRANT	DISTANCE FROM TP

† Soucher, P.G. Bathurst, R.R. Arndt and R.J. Spence, Geology of the Conterminous U.S. at 1:2,500,000 Scale - A digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1991)

‡ U.S. EPA Ground Water Handbook, Vol I: Ground Water and Contamination, Office of Research and development EPA/625/6-90/016a October 4, page 19, September 1990

§ EDR AQUIFLOW™ information System of hydrogeologically determined groundwater flow directions at selected locations. See the back pages of the UNDI of this report for a complete description.

GEOCHECK VERSION 2.1
SUMMARY

STATE DATABASE WELL INFORMATION

WELL QUADRANT	DISTANCE FROM TP
Eastern	1 - 2 Miles
Southern	1 - 2 Miles
Western	1/2 - 1 Mile

PUBLIC WATER SUPPLY SYSTEM INFORMATION

Searched by Nearest PWS.
NOTE: PWS System location is not always the same as well location.

PWS Name: VANCEBURG UTILITIES
LAWRENCE HINES
P O BOX 117
VANCEBURG, KY 411790000

Location Relative to TP: 1 - 2 Miles West

PWS currently has or has had major violation(s) or enforcement: No

AREA RADON INFORMATION

EPA Radon Zone for LEWIS County: 2

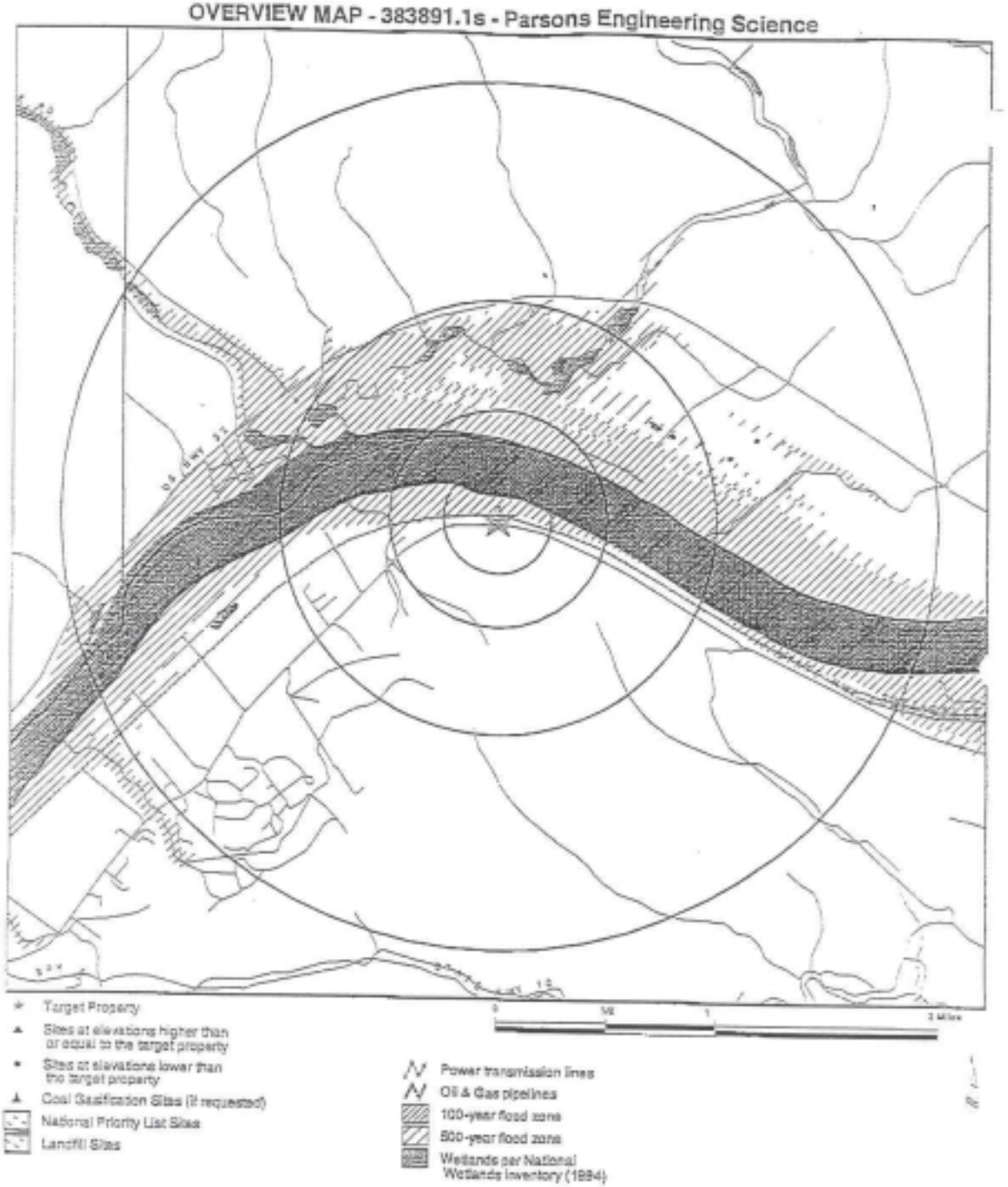
Note: Zone 1 indoor average level > 4 pCi/L.
: Zone 2 indoor average level >= 2 pCi/L and <= 4 pCi/L.
: Zone 3 indoor average level < 2 pCi/L.

Zip Code: 41141

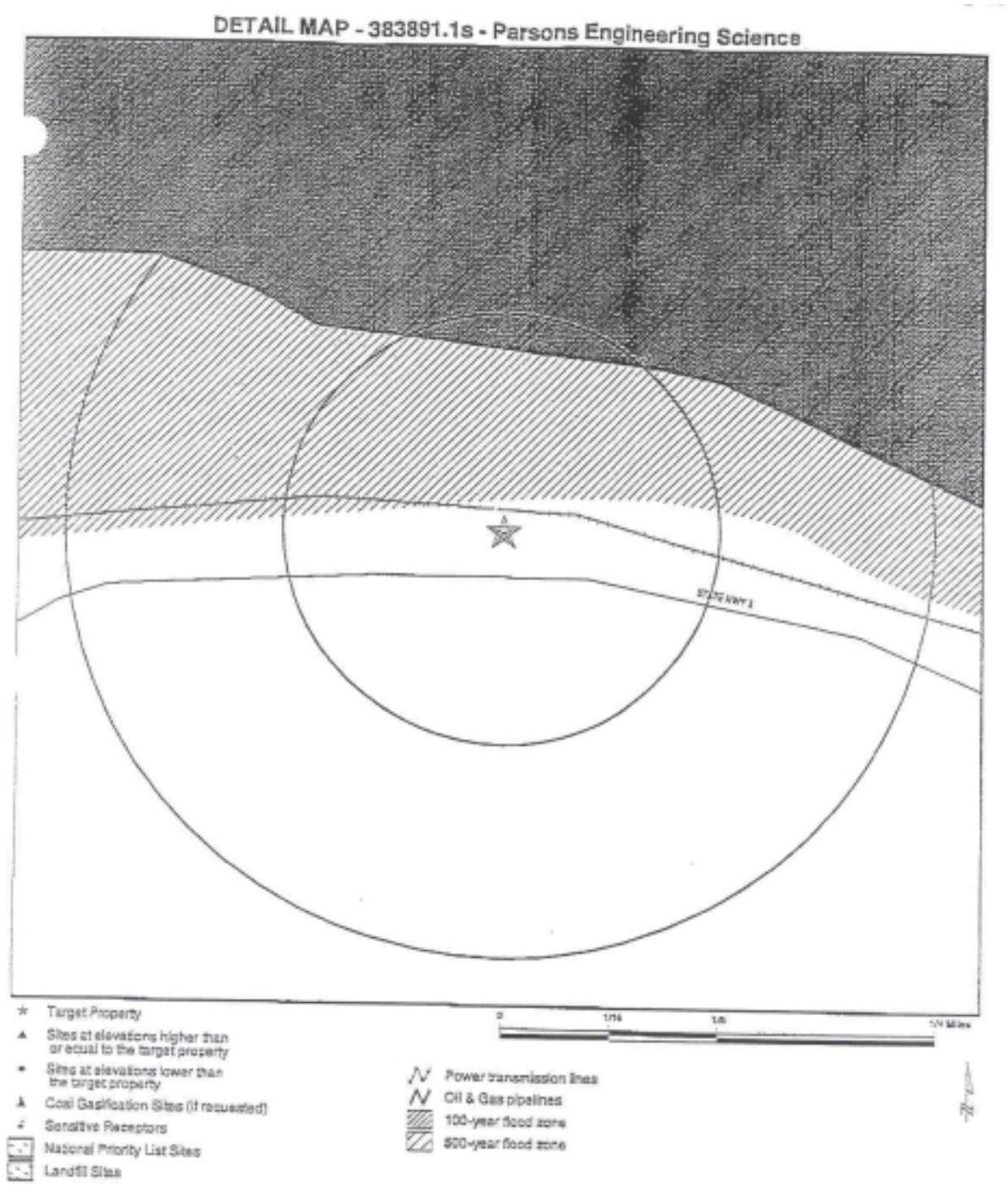
Number of sites tested: 1

Area	Average Activity	% <4 pCi/L	% 4-20 pCi/L	% >20 pCi/L
Living Area - 1st Floor	0.600 pCi/L	100%	0%	0%
Living Area - 2nd Floor	Not Reported	Not Reported	Not Reported	Not Reported
Basement	Not Reported	Not Reported	Not Reported	Not Reported

OVERVIEW MAP - 383891.1s - Parsons Engineering Science



TARGET PROPERTY:	OH-06, River Mile 373.2-372	CUSTOMER:	Parsons Engineering Science
ADDRESS:	OH-06, River Mile 373.2-372	CONTACT:	Mr. Bruce Cox
CITY/STATE/ZIP:	Garrison KY 41141	INQUIRY #:	383891.1s
LAT/LONG:	38.5230 / 83.2368	DATE:	June 24, 1999 10:35 am


DETAIL MAP - 383891.1s - Parsons Engineering Science
Target Property
Sites at elevations higher than or equal to the target property
Sites at elevations lower than the target property
Coal Gasification Sites (if requested)
Sensitive Receptors
National Priority List Sites
Landfill Sites
Power transmission lines
Oil & Gas pipelines
100-year flood zone
500-year flood zone
TARGET PROPERTY: OH-06, River Mile 373.2-372
ADDRESS: OH-06, River Mile 373.2-372
CITY/STATE/ZIP: Garrison KY 41141
LAT/LONG: 38.6230 / 83.2366
CUSTOMER: Parsons Engineering Science
CONTACT: Mr. Bruce Cox
INQUIRY #: 383891.1s
DATE: June 24, 1999 10:35 am

MAP FINDINGS SUMMARY SHOWING ALL SITES

Database	Target Property	Search Distance (Miles)	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
NPL		1.750	0	0	0	0	0	0
Delisted NPL		TP	NR	NR	NR	NR	NR	0
RCRIS-TSD		1.250	0	0	0	0	0	0
State Haz. Waste		1.750	0	0	0	0	0	0
CERCLIS		1.250	0	0	0	0	0	0
CERC-NFRAP		TP	NR	NR	NR	NR	NR	0
CORRACTS		1.750	0	0	0	0	0	0
State Landfill		1.250	0	0	0	0	0	0
LUST		N/A	N/A	N/A	N/A	N/A	N/A	N/A
UST		1.000	0	0	0	0	NR	0
RAATS		TP	NR	NR	NR	NR	NR	0
RCRIS Sm. Quan. Gen.		1.000	0	0	0	0	NR	0
RCRIS Lg. Quan. Gen.		1.000	0	0	0	0	NR	0
HMIRS		TP	NR	NR	NR	NR	NR	0
PADS		TP	NR	NR	NR	NR	NR	0
ERNS		TP	NR	NR	NR	NR	NR	0
FINDS		TP	NR	NR	NR	NR	NR	0
TRIS		TP	NR	NR	NR	NR	NR	0
NPL Liens		TP	NR	NR	NR	NR	NR	0
TSCA		TP	NR	NR	NR	NR	NR	0
MLTS		TP	NR	NR	NR	NR	NR	0
ROD		1.750	0	0	0	0	0	0
CONSENT		1.750	0	0	0	0	0	0
MINES		1.000	0	0	0	0	NR	0

TP = Target Property

NR = Not Requested at this Search Distance

* Sites may be listed in more than one database

MAP FINDINGS SUMMARY SHOWING ONLY SITES HIGHER THAN OR THE SAME ELEVATION AS TP

Database	Target Property	Search Distance (Miles)	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
NPL		1.750	0	0	0	0	0	0
Delisted NPL		TP	NR	NR	NR	NR	NR	0
RCRIS-TSD		1.250	0	0	0	0	0	0
State Haz. Waste		1.750	0	0	0	0	0	0
CERCLIS		1.250	0	0	0	0	0	0
CERC-NFRAP		TP	NR	NR	NR	NR	NR	0
CORRACTS		1.750	0	0	0	0	0	0
State Landfill		1.250	0	0	0	0	0	0
LUST		N/A	N/A	N/A	N/A	N/A	N/A	N/A
UST		1.000	0	0	0	0	NR	0
RAATS		TP	NR	NR	NR	NR	NR	0
RCRIS Sm. Quan. Gen.		1.000	0	0	0	0	NR	0
RCRIS Lg. Quan. Gen.		1.000	0	0	0	0	NR	0
HMIRS		TP	NR	NR	NR	NR	NR	0
PADS		TP	NR	NR	NR	NR	NR	0
ERNS		TP	NR	NR	NR	NR	NR	0
FINDS		TP	NR	NR	NR	NR	NR	0
TRIS		TP	NR	NR	NR	NR	NR	0
NPL Liens		TP	NR	NR	NR	NR	NR	0
TSCA		TP	NR	NR	NR	NR	NR	0
MLTS		TP	NR	NR	NR	NR	NR	0
ROD		1.750	0	0	0	0	0	0
CONSENT		1.750	0	0	0	0	0	0
MINES		1.000	0	0	0	0	NR	0

TP = Target Property

NR = Not Requested at this Search Distance

* Sites may be listed in more than one database

Map ID
Direction
Distance
Distance (ft.)
Elevation Site

MAP FINDINGS

Database(s) EDR ID Number EPA ID Number

Coal Gas Site Search: EDR does not presently have coal gas site information available in this state.

NO SITES FOUND

City	EDR ID	Site Name	Site Address	Zip	Database(s)	Facility ID
GARRISON	U003720338	GARRISON ELEMENTARY SCHOOL	ROUTE 10	41141	UST	
GARRISON	U001102829	GAS FULL SERVICE GAS	RT 10	41141	UST	
GARRISON	U003078854	GARRISON GP INC	HWY 10 RT 8	41141	UST	
GARRISON	U001442039	DOUBLE A TRUCK STOP	RT 546	41141	UST	
GARRISON	1006510368	MP 547.38 LEWIS COUNTY	5 MILE OFF HIGHWAY 10	41141	RCRIS-SQG, FINDS	
GARRISON	1004077419	TYLERS GAS	OLD ROUTE 10	41141	RCRIS-SQG, FINDS	
GARRISON	U003841725	BENTLEY BROTHERS MARKET	HWY RT 8	41141	UST	
STOUT	S101144524	VICS GROCERY	721 US RT 52	45684	LUST	10247
STOUT	S101645405	BUENA VISTA GENERAL STORE	598 US RT 52	45684	LUST	738216
STOUT	S102272474	MARATHON MARINA MART	10781 ST RT 52 W	45684	LUST	736089

GEOCHECK VERSION 2.1 ADDENDUM
FEDERAL DATABASE WELL INFORMATION

Well Closest to Target Property (Northern Quadrant)

BASIC WELL DATA

Site ID:	383742083140200	Distance from TP:	1/4 - 1/2 Mile
Site Type:	Single well, other than collector or Ranney type		
Year Constructed:	1965	County:	Scioto
Altitude:	Not Reported	State:	Ohio
Well Depth:	72.00 ft.	Topographic Setting:	Not Reported
Depth to Water Table:	38.00 ft.	Prim. Use of Site:	Withdrawal of water
Date Measured:	03161965	Prim. Use of Water:	Public supply

LITHOLOGIC DATA

Geologic Age ID (Era/System/Series):	Cenozoic-Quaternary
Principal Lithology of Unit:	Glacial (undifferentiated)
Further Description:	SAND & GRAVEL

WATER LEVEL VARIABILITY

Not Reported

GEOCHECK VERSION 2.1
FEDERAL DATABASE WELL INFORMATION

Well Closest to Target Property (Eastern Quadrant)

BASIC WELL DATA

Site ID:	383639083103901	Distance from TP:	>2 Miles
Site Type:	Single well, other than collector or Ranney type		
Year Constructed:	1967	County:	Lewis
Altitude:	530.00 ft.	State:	Kentucky
Well Depth:	78.00 ft.	Topographic Setting:	Not Reported
Depth to Water Table:	48.00 ft.	Prim. Use of Site:	Withdrawal of water
Date Measured:	Not Reported	Prim. Use of Water:	Public supply

LITHOLOGIC DATA

Not Reported

WATER LEVEL VARIABILITY

Not Reported

GEOCHECK VERSION 2.1
FEDERAL DATABASE WELL INFORMATION

Well Closest to Target Property (Southern Quadrant)

BASIC WELL DATA

Site ID:	383605083153001	Distance from TP:	1 - 2 Miles
Site Type:	Spring		
Year Constructed:	Not Reported	County:	Lewis
Altitude:	560.00 ft.	State:	Kentucky
Well Depth:	Not Reported	Topographic Setting:	Alluvial or marine terrace
Depth to Water Table:	Not Reported	Prim. Use of Site:	Not Reported
Date Measured:	Not Reported	Prim. Use of Water:	Not Reported

LITHOLOGIC DATA

Not Reported

WATER LEVEL VARIABILITY

Not Reported

GEOCHECK VERSION 2.1
FEDERAL DATABASE WELL INFORMATION

Well Closest to Target Property (Western Quadrant)

BASIC WELL DATA

Site ID:	383629083153101	Distance from TP:	1 - 2 Miles
Site Type:	Single well, other than collector or Ranney type		
Year Constructed:	1946	County:	Lewis
Altitude:	580.00 ft.	State:	Kentucky
Well Depth:	157.00 ft.	Topographic Setting:	Valley flat
Depth to Water Table:	94.57 ft.	Prim. Use of Site:	Withdrawal of water
Date Measured:	09121957	Prim. Use of Water:	Domestic

LITHOLOGIC DATA

Geologic Age ID (Era/System/Series):	Cenozoic-Quaternary-Holocene
Principal Lithology of Unit:	Alluvium
Further Description:	Not Reported

WATER LEVEL VARIABILITY

Not Reported

GEOCHECK VERSION 2.1
STATE DATABASE WELL INFORMATION

Water Well Information:

Well Within 1 - 2 Miles of Target Property (Eastern Quadrant)

Well ID:	00026529		
Well Usage:	DOMESTIC	Source Name:	Division of Water
Latitude:	38.605559	Longitude:	-83.214167

Well Within 1 - 2 Miles of Target Property (Southern Quadrant)

Well ID:	00003700		
Well Usage:	DOMESTIC	Source Name:	KY Geological Survey
Latitude:	38.607500	Longitude:	-83.216944

Well Within 1/2 - 1 Mile of Target Property (Western Quadrant)

Well ID:	00015542		
Well Usage:	DOMESTIC	Source Name:	Division of Water
Latitude:	38.621389	Longitude:	-83.247222

GEOCHECK VERSION 2.1
PUBLIC WATER SUPPLY SYSTEM INFORMATION

Searched by Nearest PWS.

PWS SUMMARY:

PWS ID:	KY0680438	PWS Status:	Active	Distance from TP:	1 - 2 Miles
Date Initiated:	September / 1973	Date Deactivated:	Not Reported	Dir relative to TP:	West
PWS Name:	VANCEBURG UTILITIES LAWRENCE HINES P O BOX 117 VANCEBURG, KY 411790000				
Addressee / Facility:	Not Reported				
Facility Latitude:	38 35 16		Facility Longitude: 083 15 50		
City Served:	VANCEBURG				
Treatment Class:	Treated		Population Served: 3,301 - 5,000 Persons		

PWS currently has or has had major violation(s) or enforcement: No

TC383891.1s Page A6

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

To maintain currency of the following federal and state databases, EDR contacts the appropriate governmental agency on a monthly or quarterly basis, as required.

Elapsed ASTM days: Provides confirmation that this EDR report meets or exceeds the 90-day updating requirement of the ASTM standard.

FEDERAL ASTM RECORDS:

CERCLIS: Comprehensive Environmental Response, Compensation, and Liability Information System
Source: EPA
Telephone: 703-413-0223
CERCLIS contains data on potentially hazardous waste sites that have been reported to the USEPA by states, municipalities, private companies and private persons, pursuant to Section 103 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). CERCLIS contains sites which are either proposed to or on the National Priorities List (NPL) and sites which are in the screening and assessment phase for possible inclusion on the NPL.

Date of Government Version: 04/21/99
Date Made Active at EDR: 06/09/99
Database Release Frequency: Quarterly

Date of Data Arrival at EDR: 05/14/99
Elapsed ASTM days: 26
Date of Last EDR Contact: 03/03/99

ERNS: Emergency Response Notification System
Source: EPA/NTIS
Telephone: 202-260-2342
Emergency Response Notification System. ERNS records and stores information on reported releases of oil and hazardous substances.

Date of Government Version: 12/31/98
Date Made Active at EDR: 01/18/99
Database Release Frequency: Quarterly

Date of Data Arrival at EDR: 01/13/99
Elapsed ASTM days: 5
Date of Last EDR Contact: 01/04/99

NPL: National Priority List
Source: EPA
Telephone: N/A
National Priorities List (Superfund). The NPL is a subset of CERCLIS and identifies over 1,200 sites for priority cleanup under the Superfund Program. NPL sites may encompass relatively large areas. As such, EDR provides polygon coverage for over 1,000 NPL site boundaries produced by EPA's Environmental Photographic Interpretation Center (EPIC).

Date of Government Version: 05/10/99
Date Made Active at EDR: 06/09/99
Database Release Frequency: Semi-Annually

Date of Data Arrival at EDR: 05/12/99
Elapsed ASTM days: 28
Date of Last EDR Contact: 02/08/99

RCRIS: Resource Conservation and Recovery Information System
Source: EPA/NTIS
Telephone: 800-424-9346
Resource Conservation and Recovery Information System. RCRIS includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA).

Date of Government Version: 04/26/99
Date Made Active at EDR: 06/09/99
Database Release Frequency: Semi-Annually

Date of Data Arrival at EDR: 05/14/99
Elapsed ASTM days: 26
Date of Last EDR Contact: 03/31/99

CORRACTS: Corrective Action Report
Source: EPA
Telephone: 800-424-9346
CORRACTS identifies hazardous waste handlers with RCRA corrective action activity.

Date of Government Version: 03/01/99
Date Made Active at EDR: 04/16/99
Database Release Frequency: Semi-Annually

Date of Data Arrival at EDR: 03/17/99
Elapsed ASTM days: 30
Date of Last EDR Contact: 03/15/99

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

PADS: PCB Activity Database System
Source: EPA
Telephone: 202-260-3936
PCB Activity Database. PADS identifies generators, transporters, commercial storers and/or brokers and disposers of PCB's who are required to notify the EPA of such activities.

Date of Government Version: 09/22/97
Database Release Frequency: No Update Planned

Date of Last EDR Contact: 03/05/99
Date of Next Scheduled EDR Contact: 06/17/99

RAATS: RCRA Administrative Action Tracking System
Source: EPA
Telephone: 202-564-4104
RCRA Administration Action Tracking System. RAATS contains records based on enforcement actions issued under RCRA pertaining to major violators and includes administrative and civil actions brought by the EPA. For administration actions after September 30, 1995, data entry in the RAATS database was discontinued. EPA will retain a copy of the database for historical records. It was necessary to terminate RAATS because a decrease in agency resources made it impossible to continue to update the information contained in the database.

Date of Government Version: 04/17/95
Database Release Frequency: No Update Planned

Date of Last EDR Contact: 03/15/99
Date of Next Scheduled EDR Contact: 06/14/99

ROD: Records Of Decision
Source: NTIS
Telephone: 703-416-0223
Record of Decision. ROD documents mandate a permanent remedy at an NPL (Superfund) site containing technical and health information to aid in the cleanup.

Date of Government Version: 01/31/99
Database Release Frequency: Annually

Date of Last EDR Contact: 04/19/99
Date of Next Scheduled EDR Contact: 07/19/99

TRIS: Toxic Chemical Release Inventory System
Source: EPA
Telephone: 202-260-1531
Toxic Release Inventory System. TRIS identifies facilities which release toxic chemicals to the air, water and land in reportable quantities under SARA Title III Section 313.

Date of Government Version: 12/31/97
Database Release Frequency: Annually

Date of Last EDR Contact: 04/01/99
Date of Next Scheduled EDR Contact: 06/28/99

TSCA: Toxic Substances Control Act
Source: EPA
Telephone: 202-260-1444
Toxic Substances Control Act. TSCA identifies manufacturers and importers of chemical substances included on the TSCA Chemical Substance Inventory list. It includes data on the production volume of these substances by plant site.

Date of Government Version: 12/31/94
Database Release Frequency: Every 4 Years

Date of Last EDR Contact: 04/26/99
Date of Next Scheduled EDR Contact: 07/26/99

MINES: Mines Master Index File
Source: Department of Labor, Mine Safety and Health Administration
Telephone: 303-231-5959

Date of Government Version: 08/01/98
Database Release Frequency: Semi-Annually

Date of Last EDR Contact: 04/08/99
Date of Next Scheduled EDR Contact: 07/05/99

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

STATE OF KENTUCKY ASTM RECORDS:

LUST: N/A
Source: Department of Environmental Protection
Telephone: 502-564-6716
Leaking Underground Storage Tank Incident Reports. LUST records contain an inventory of reported leaking underground storage tank incidents. Not all states maintain these records, and the information stored varies by state.

Date of Government Version: N/A
Date Made Active at EDR: N/A
Database Release Frequency: No Update Planned

Date of Data Arrival at EDR: N/A
Elapsed ASTM days: 0
Date of Last EDR Contact: 02/16/99

SHWS: State Leads List
Source: Department of Environmental Protection
Telephone: 502-564-6716
State Hazardous Waste Sites. State hazardous waste site records are the states' equivalent to CERCLIS. These sites may or may not already be listed on the federal CERCLIS list. Priority sites planned for cleanup using state funds (state equivalent of Superfund) are identified along with sites where cleanup will be paid for by potentially responsible parties. Available information varies by state.

Date of Government Version: 12/28/98
Date Made Active at EDR: 02/15/99
Database Release Frequency: Quarterly

Date of Data Arrival at EDR: 01/14/99
Elapsed ASTM days: 32
Date of Last EDR Contact: 04/05/99

LF: Solid Waste Facilities List
Source: Department of Environmental Protection
Telephone: 502-564-6716
Solid Waste Facilities/Landfill Sites. SWF/LF type records typically contain an inventory of solid waste disposal facilities or landfills in a particular state. Depending on the state, these may be active or inactive facilities or open dumps that failed to meet RCRA Subtitle D Section 4004 criteria for solid waste landfills or disposal sites.

Date of Government Version: 02/01/99
Date Made Active at EDR: 04/01/99
Database Release Frequency: Semi-Annually

Date of Data Arrival at EDR: 03/01/99
Elapsed ASTM days: 31
Date of Last EDR Contact: 02/25/99

UST: Underground Storage Tank Database
Source: Department of Environmental Protection
Telephone: 502-564-6716
Registered Underground Storage Tanks. UST's are regulated under Subtitle I of the Resource Conservation and Recovery Act (RCRA) and must be registered with the state department responsible for administering the UST program. Available information varies by state program.

Date of Government Version: 02/08/99
Date Made Active at EDR: 03/12/99
Database Release Frequency: Quarterly

Date of Data Arrival at EDR: 03/16/99
Elapsed ASTM days: 24
Date of Last EDR Contact: 04/05/99

Historical and Other Database(s)

Depending on the geographic area covered by this report, the data provided in these specialty databases may or may not be complete. For example, the existence of wetlands information data in a specific report does not mean that all wetlands in the area covered by the report are included. Moreover, the absence of any reported wetlands information does not necessarily mean that wetlands do not exist in the area covered by the report.

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Former Manufactured Gas (Coal Gas) Sites: The existence and location of Coal Gas sites is provided exclusively to EDR by Real Property Scan, Inc. For a technical description of the types of hazards which may be found at such sites, contact your EDR customer service representative.

Disclaimer Provided by Real Property Scan, Inc.

The information contained in this report has predominantly been obtained from publicly available sources produced by entities other than Real Property Scan. While reasonable steps have been taken to insure the accuracy of this report, Real Property Scan does not guarantee the accuracy of this report. Any liability on the part of Real Property Scan is strictly limited to a refund of the amount paid. No claim is made for the actual existence of toxins at any site. This report does not constitute a legal opinion.

DELISTED NPL: NPL Deletions
Source: EPA
Telephone: N/A
The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establishes the criteria that the EPA uses to delete sites from the NPL. In accordance with 40 CFR 300.425.(e), sites may be deleted from the NPL where no further response is appropriate.

Date of Government Version: 04/23/99
Date Made Active at EDR: 05/09/99
Database Release Frequency: Semi-Annually

Date of Data Arrival at EDR: 05/12/99
Elapsed ASTM days: 28
Date of Last EDR Contact: 02/08/99

NFRAP: No Further Remedial Action Planned
Source: EPA
Telephone: 703-413-0223
As of February 1995, CERCLIS sites designated "No Further Remedial Action Planned" (NFRAP) have been removed from CERCLIS. NFRAP sites may be sites where, following an initial investigation, no contamination was found, contamination was removed quickly without the need for the site to be placed on the NPL, or the contamination was not serious enough to require Federal Superfund action or NPL consideration. EPA has removed approximately 25,000 NFRAP sites to lift the unintended barriers to the redevelopment of these properties and has archived them as historical records so EPA does not needlessly repeat the investigations in the future. This policy change is part of the EPA's Brownfields Redevelopment Program to help cities, states, private investors and affected citizens to promote economic redevelopment of unproductive urban sites.

Date of Government Version: 04/21/99
Date Made Active at EDR: 05/09/99
Database Release Frequency: Quarterly

Date of Data Arrival at EDR: 05/14/99
Elapsed ASTM days: 26
Date of Last EDR Contact: 03/03/99

PWS: Public Water Systems
Source: EPA/Office of Drinking Water
Telephone: 202-260-2805
Public Water System data from the Federal Reporting Data System. A PWS is any water system which provides water to at least 25 people for at least 60 days annually. PWSs provide water from wells, rivers and other sources.

PWS ENF: Public Water Systems Violation and Enforcement Data
Source: EPA/Office of Drinking Water
Telephone: 202-260-2805
Violation and Enforcement data for Public Water Systems from the Safe Drinking Water Information System (SWDIS) after August 1995. Prior to August 1995, the data came from the Federal Reporting Data System (FRDS).

Area Radon Information: The National Radon Database has been developed by the U.S. Environmental Protection Agency (USEPA) and is a compilation of the EPA/State Residential Radon Survey and the National Residential Radon Survey. The study covers the years 1986 - 1992. Where necessary data has been supplemented by information collected at private sources such as universities and research institutions.

EPA Radon Zones: Sections 307 & 309 of IRAA directed EPA to list and identify areas of U.S. with the potential for elevated indoor radon levels.

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Oil/Gas Pipelines/Electrical Transmission Lines: This data was obtained by EDR from the USGS in 1994. It is referred to by USGS as GeoData Digital Line Graphs from 1:100,000-Scale Maps. It was extracted from the transportation category including some oil, but primarily gas pipelines and electrical transmission lines.

Sensitive Receptors: There are individuals deemed sensitive receptors due to their fragile immune systems and special sensitivity to environmental discharges. These sensitive receptors typically include the elderly, the sick, and children. While the location of all sensitive receptors cannot be determined, EDR indicates those buildings and facilities - schools, daycares, hospitals, medical centers, and nursing homes - where individuals who are sensitive receptors are likely to be located.

USGS Water Wells: In November 1971 the United States Geological Survey (USGS) implemented a national water resource information tracking system. This database contains descriptive information on sites where the USGS collects or has collected data on surface water and/or groundwater. The groundwater data includes information on more than 900,000 wells, springs, and other sources of groundwater.

Flood Zone Data: This data, available in select counties across the country, was obtained by EDR in 1999 from the Federal Emergency Management Agency (FEMA). Data depicts 100-year and 500-year flood zones as defined by FEMA.

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in March 1997 from the U.S. Fish and Wildlife Service.

Epicenters: World earthquake epicenters, Richter 5 or greater
Source: Department of Commerce, National Oceanic and Atmospheric Administration

Water Dams: National Inventory of Dams
Source: Federal Emergency Management Agency
Telephone: 202-646-2801
National computer database of more than 74,000 dams maintained by the Federal Emergency Management Agency.

Kentucky Well Data Files
Source: University of Kentucky, Geological Survey
Telephone: 606-257-5500

APPENDIX C Plan Formulation and Incremental Analysis Checklist

Project Site Location: (Include enough description or landmarks to find).

The proposed Upper Twin Creek "T" Dikes project area is located in Scioto County, Ohio approximately 14.5 miles southwest of Portsmouth, Ohio. The project site is in the Ohio River Meldahl Pool between Ohio River Mile (ORM) 372 and 373. The project site is within the jurisdiction of the Huntington District, U.S. Army Corps of Engineers (USACE).

Description of Plan selected:

A group of ten "T" shaped boulder (rip-rap) structures will be created upstream from Upper Twin Creek along the main channel border of the Ohio River. The boulder piles will be constructed at various depths and at various distances from the shoreline outside of the navigation channel to maximize habitat heterogeneity. The "T" dikes structures will also provide winter velocity shelters for fishes.

Alternatives of the Selected Plan:

Smaller Size Plans Possible? Yes and description

Reduce the number of "T" dike structures.

Larger Size Plan Possible? Yes and description

Increase the size and number of "T" dike structures.

Other alternatives? No

Restore/Enhance/Protect Terrestrial Habitats? **Opportunity numbers met**

Restore, Enhance, & Protect Wetlands? **Opportunity numbers met**

Restore/Enhance/Protect Aquatic Habitats? Yes **Opportunity numbers met** A5, A6

Type species benefited: Fish and invertebrates including mussels.

Endangered species benefited: Potential benefits to mussel species.

Can estimated amount of habitat units be determined:

Plan acceptable to Resources Agencies?
U.S. Fish & Wildlife Service?
State Department of Natural Resources? Yes – Ohio DNR

Plan considered complete? **Connected to other plans for restoration?**

Real Estate owned by State Agency? **Federal Agency?**
Real Estate privately owned? No
If privately owned, what is status of future acquisition?

Terrestrial Habitat Opportunities

T1- Restore riparian corridors, reduce fragmentation by expanding and joining isolated habitat blocks and stabilize eroding banks.

T2 Restore, protect existing islands and create islands where they historically occurred.

T3 Restore hardwood forests in the 100-year floodplain.

Wetland Habitat Opportunities

W1 Forested Wetlands: Restore Forested Wetlands: Bottomland Hardwoods

W2 Forested Wetlands: Restore Forested Wetlands:Cypress/Tupelo Swamps and other unique forested wetlands

W3 Restore Scrub/Shrub Emergent Wetlands: including those areas isolated from the river except during high water and those contiguous with embayments and island sloughs.

Aquatic Habitat Opportunities

A1 Restore backwaters (Including sloughs, embayments, oxbows, bayous, etc.).

A2 Restore riverine submerged and emergent aquatic vegetation

A3 Restore and protect sand and gravel bars.

A4 Protect tailwaters and provide structures to provide refuge for fish.

A5 Create and protect fish and mussel refuges in pools (deep water, slow velocity, soft substrate)

A6 Restore and protect aquatic habitat (Side Channel/Back Channel Habitat)

Other

O-1 Restore other habitats(e.g., canebrakes, river bluffs mussel beds, etc.)

APPENDIX D Micro Computer-Aided Cost Engineering System (MCACES)

Upper Twin T Dikes
Ohio River Mainstem
Ecosystem Restoration Project

Sample Feasibility Cost Estimate

Designed By:	Parsons Engineering Science, Inc
Estimated By:	
Prepared By:	Parsons Engineering/CELRL-ED-MC
	CELRL-ED-MC POC: M. Lockard
Preparation Date:	06/20/00
Effective Date of Pricing:	06/20/00
Est Construction Time:	180 Days
Sales Tax:	0.00%

M C A C E S G O L D E D I T I O N
Composer GOLD Software Copyright (c) 1985-1994
by Building Systems Design, Inc.
Release 5.30A

ABOR ID: FTCAMP EQUIP ID: NAT97A Currency in DOLLARS CREW ID: NAT99A UPB ID: UP99EA

pper Twin Creek "T" Dikes	QUANTY	UOM	CREW ID	OUTPUT	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT
Lands and Damages					0	0	0	47,100	47,100	
Habitat & Feeding Facilities										
'T' Dikes (Group of Ten)										
Excavation										
HYD EXCAV, CRWLR, 2.50 CY B KT	7.14	HR	H25BA004	1.00	0	508	0	0	508	71.16
Outside Equip. Op. Medium	7.14	HR	X-EQOPRMED	1.00	145	0	0	0	145	20.25
WORK FLOAT, MED DUTY, 30'X10'X3'	7.14	HR	M10MZ003	1.00	0	12	0	0	12	1.71
Outside Laborer	7.14	HR	X-LABORER	1.00	163	0	0	0	163	22.81
TUG BOAT, 150 TO 400 HP	7.14	HR	XX0XX004	1.00	0	183	0	0	183	25.66
Outside Equip. Op. Medium	7.14	HR	X-EQOPRMED	1.00	145	0	0	0	145	20.25
TUG BOAT, 500 TO 800 HP	7.14	HR	XX0XX002	1.00	0	455	0	0	455	63.68
Outside Equip. Op. Medium	7.14	HR	X-EQOPRMED	1.00	145	0	0	0	145	20.25
WORK BARGE-S,MED DUTY,60'X16'X5'	57.14	HR	M10MZ009	1.00	0	304	0	0	304	5.32
Outside Laborer	7.14	HR	X-LABORER	1.00	166	0	0	0	166	23.31
Outside Laborer	7.14	HR	X-LABORER	1.00	163	0	0	0	163	22.81
Excavation	1000.00	CY			926	1,463	0	0	2,389	2.39
Rock										
HYD EXCAV, CRWLR, 2.50 CY B KT	18.71	HR	H25BA004	1.00	0	1,332	0	0	1,332	71.16
Outside Equip. Op. Medium	18.71	HR	X-EQOPRMED	1.00	379	0	0	0	379	20.25
WORK FLOAT, MED DUTY, 30'X10'X3'	18.71	HR	M10MZ003	1.00	0	32	0	0	32	1.71
Outside Laborer	18.71	HR	X-LABORER	1.00	427	0	0	0	427	22.81
TUG BOAT, 150 TO 400 HP	18.71	HR	XX0XX004	1.00	0	480	0	0	480	25.66
Outside Equip. Op. Medium	18.71	HR	X-EQOPRMED	1.00	379	0	0	0	379	20.25
TUG BOAT, 500 TO 800 HP	18.71	HR	XX0XX002	1.00	0	1,192	0	0	1,192	63.68
Outside Equip. Op. Medium	18.71	HR	X-EQOPRMED	1.00	379	0	0	0	379	20.25
WORK BARGE-S,MED DUTY,60'X16'X5'	149.71	HR	M10MZ009	1.00	0	797	0	0	797	5.32

Outside Laborer	18.71	HR	X-LABORER	1.00	430	0	0	0	430	23.31
Outside Laborer	18.71	HR	X-LABORER	1.00	427	0	0	0	427	22.81
Rip Rap, 10# to 200# Pieces Random, Dumped from Truck onto barge to be shipped to site.	2620.00	CY	COETF	32.00	29,821	4,253	63,876	0	97,950	37.39
Rock	2620.00	CY			32,248	8,086	63,876	0	104,210	39.77

ABOR ID: FTCAMP EQUIP ID: NAT97A Currency in DOLLARS CREW ID: NAT99A UPB ID: UP99EA

pper Twin Creek "T" Dikes	QUANTY	UOM	CREW ID	OUTPUT	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT
Mobilization										
MOBILIZATION	1.00	EA		0.00	0	0	15,000	0	15,000	15000
Mobilization	1.00	EA			0	0	15,000	0	15,000	15000
'T' Dikes (Group of Ten)	1.00	EA			33,174	9,549	78,876	0	121,599	121599
Habitat & Feeding Facilitie					33,174	9,549	78,876	0	121,599	
Planning, Engineering & Des					0	0	0	31,100	31,100	
Engineering During					0	0	0	2,500	2,500	
Construction Management					0	0	0	16,000	16,000	
Upper Twin Creek "T" Dikes					33,174	9,549	78,876	96,700	218,299	
Ohio					33,174	9,549	78,876	96,700	218,299	
Upper Twin T Dikes					33,174	9,549	78,876	96,700	218,299	

ABOR ID: FTCAMP EQUIP ID: NAT97A Currency in DOLLARS CREW ID: NAT99A UPB ID: UP99EA

			QUANTY	UOM	CONTRACT	CONTINGN	TOTAL COST	UNIT
04	Ohio							
04-05	Upper Twin Creek "T" Dikes							
04-05{	0100	Lands and Damages			47,100	7,125	54,225	
04-05{	0603	Fish & Wildlife Facilities and			121,599	30,400	151,999	
04-05{	3000	Planning, Engineering & Design			33,600	6,720	40,320	
04-05{	3100	Construction Management			16,000	3,200	19,200	
	TOTAL	Upper Twin Creek "T" Dikes			218,299	47,445	265,744	
	TOTAL	Ohio			218,299	47,445	265,744	
	TOTAL	Upper Twin T Dikes			218,299	47,445	265,744	

ABOR ID: FTCAMP EQUIP ID: NAT97A Currency in DOLLARS CREW ID: NAT99A UPB ID: UP99EA

	QUANTY	UOM	CONTRACT	CONTINGN	TOTAL COST	UNIT
04 Ohio						
04-05 Upper Twin Creek "T" Dikes						
04-05{ 0100 Lands and Damages						
04-05{ 010000 Lands and Damages			47,100	7,125	54,225	
TOTAL Lands and Damages			47,100	7,125	54,225	
04-05{ 0603 Fish & Wildlife Facilities and						
04-05{ 060373 Habitat & Feeding Facilities						
04-05{ 060373}1 'T' Dikes (Group of Ten)	1.00	EA	121,599	30,400	151,999	151999
TOTAL Habitat & Feeding Facilities			121,599	30,400	151,999	
TOTAL Fish & Wildlife Facilities and			121,599	30,400	151,999	
04-05{ 3000 Planning, Engineering & Design						
04-05{ 300001 Planning, Engineering & Design			31,100	6,220	37,320	
04-05{ 300002 Engineering During			2,500	500	3,000	
TOTAL Planning, Engineering & Design			33,600	6,720	40,320	
04-05{ 3100 Construction Management						
04-05{ 310001 Construction Management			16,000	3,200	19,200	
TOTAL Construction Management			16,000	3,200	19,200	
TOTAL Upper Twin Creek "T" Dikes			218,299	47,445	265,744	
TOTAL Ohio			218,299	47,445	265,744	

TOTAL Upper Twin T Dikes	218,299	47,445	265,744

ABOR ID: FTCAMP EQUIP ID: NAT97A Currency in DOLLARS CREW ID: NAT99A UPB ID: UP99EA

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ABOR ID: FTCAMP EQUIP ID: NAT97A Currency in DOLLARS CREW ID: NAT99A UPB ID: UP99EA

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o Backup Reports...

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EXHIBIT H-4

July 2000

PRELIMINARY FINAL REPORT

INCREMENTAL ANALYSIS OF THE UPPER TWIN CREEK "T" DIKES PROJECT, OHIO

Submitted to

U.S. Army Corps of Engineer
Louisville District
Louisville, Kentucky

Submitted by

Federal Programs Division
Baton Rouge, Louisiana

July 2000

PRELIMINARY FINAL REPORT

Contract No. DACW27-99-D-0019
Delivery Order No. 0004
GEC Project No. 22321304

INCREMENTAL ANALYSIS OF THE UPPER TWIN CREEK "T" DIKES PROJECT, OHIO

Submitted to

U.S. Army Corps of Engineers
Louisville District
Louisville, Kentucky

Submitted by

G.E.C., Inc.
Baton Rouge, Louisiana

Engineering Economics Transportation Technology Social Analysis Environmental Planning

P.O. Box 84010 Baton Rouge, Louisiana 70884-4010 (225) 612-3000 Fax (225) 612-3016
9357 Interline Avenue Baton Rouge, Louisiana 70809-1910

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1.0 INTRODUCTION, PURPOSE AND NEED

This work presents an incremental analysis of the costs and benefits of the Ohio River ecosystem restoration project OH06 – Upper Twin Creek "T" Dikes, a feasibility level study associated with a proposed ecosystem restoration program for the Ohio River. This study serves as an example incremental analysis for various ecosystem components considered as part of the program. The Corps has been involved in a large ecosystem restoration study of the Ohio River extending from Cairo, Illinois, to Pittsburgh, Pennsylvania. The Louisville, Huntington, and Pittsburgh districts are currently working with other Federal agencies and six states to develop an array of ecosystem restoration projects.

The proposed Upper Twin Creek "T" Dikes project is located in Scioto County, Ohio, approximately 14.5 miles southwest of the City of Portsmouth. The project site is in the Ohio River Meldahl Pool between Ohio River Mile (ORM) 372 and 373 and is within the jurisdiction of the Huntington District, U.S. Army Corps of Engineers (USACE).

The primary goals of the Upper Twin Creek "T" Dikes project are to provide aquatic habitat diversity upstream from Upper Twin Creek and to provide velocity shelters for fishes in the Ohio River during winter and times of high flows. Increased habitat diversity would promote a sustained fishery resource and an improved recreational fishery.

Three proposed alternatives, presented below, were designed to meet the primary goals of the project.

2.0 PROPOSED ALTERNATIVES

2.1 No-Action

Currently, the Ohio River provides a habitat of limited complexity (fine sand/silt) for aquatic organisms immediately upstream of the Upper Twin Creek confluence. Under the No-Action Alternative, aquatic habitat in this portion of the river would continue to be limited.

2.2 Alternative 1. Construct 10 "T" Dikes

The Ohio River channel upstream from the mouth of Upper Twin Creek has very little habitat diversity. Because this area is on an outside bend of the river, currents limit the natural deposition of such materials as snags that would create structure. Under this alternative, a group of 10 "T" shaped dikes constructed of boulders (rip-rap) would be placed upstream from Upper Twin Creek along the main channel border of the Ohio River. A "T" dike is a large rock revetment designed to provide submerged aquatic habitat. The "T" dikes would be constructed at various depths and at various distances from the shoreline outside the navigation channel to maximize habitat heterogeneity. The "T" dikes structures will also provide velocity shelters for fishes during all seasons. The construction of the proposed "T" dikes would provide a complex structure that would increase the variability of submerged habitat. In addition to the added hard substrate, the altered water flow would enhance habitat diversity.

The proposed location of the 10 "T" dikes is east of the mouth of Upper Twin Creek along the Ohio bank of the Ohio River between ORM 372 and 373. The Ohio bank of the Ohio River east of the

mouth of Upper Twin Creek is dominated by a band of riparian trees, the dominant species of which include box elder (*Acer negundo*), black willow (*Salix nigra*), and silver maple (*Acer saccharinum).* The area appears to be highly disturbed, and the shoreline area is littered with trash, including hundreds of discarded tires. The proposed location is on an outside bend of the Ohio River off of the main navigation channel. There is minimal structure or habitat diversity in the location where the series of "T" dike structures would be positioned. The banks are characterized by mud/sand, and the bottom substrates are composed primarily of silt and fine sand.

A narrow littoral zone extends from the shoreline to approximately three yards from the bank before gradually dropping to an average depth of 12 to 14 feet at approximately 25 yards from the bank. At approximately 50 yards from the bank, the average depth is approximately 15 to 20 feet deep.

These structures would be placed in a field of 10. Each structure would be randomly positioned 25 to 50 yards from the riverbank between ORM 372 and 373. An individual structure would be 35 feet wide and 30 feet long at the top. The structure would have 1.5 to 1 side slopes, and the overall dimension would be 50 feet by 50 feet. The dike will be toed into the sub-grade a minimum of two feet and stand above the channel bottom approximately five feet. All rip-rap material would be shipped by barge to the project site. All costs for shipping are included in the material costs. The size of the rock used will be uniformly graded limestone, with each rock weighing between 50 and 150 pounds. Excavated material from site preparation can be disposed in the main river channel.

2.3 Alternative 2. Construct 20 "T" Dikes

This alternative is similar to Alternative 1, except that a group of 20 "T" dikes would be constructed upstream from Upper Twin Creek along the bank of the Ohio River between river miles 272 and 273.

The 'T" dikes would be constructed at various depths and at various distances from the shoreline outside of the navigation channel to maximize habitat heterogeneity. The "T" dikes structures will also provide velocity shelters for fishes during all seasons. The creation of the proposed "T" dikes would provide a complex structure that would increase the diversity of submerged habitat. In addition to the added hard substrate, the altered water flow would enhance habitat diversity.

These structures would be placed in a field of 20. Each structure would be randomly positioned 25 to 50 yards from the riverbank between ORM 372 and 373. An individual structure would be 35 feet wide and 30 feet long at the top. The structure would have 1.5 to 1 side slopes, and the overall dimension would be 50 feet by 50 feet. The dike will be toed into the sub-grade a minimum of two feet and stand above the channel bottom approximately five feet. All rip-rap material would be shipped by barge to the project site. All costs for shipping are included in the material costs. The size of the rock used will be uniformly graded limestone, with each rock weighing between 50 and 150 pounds. Excavated material from site preparation can be disposed in the main river channel.

2.4 Alternative 3. Construct 10 Large "T" Dikes

This alternative is similar to Alternative 1, except that 10 "T" dikes measuring 75 feet by 75 feet would be constructed along the bank of the Ohio River.

Under this alternative, a group of 10 "T" dikes would be created upstream from Upper Twin Creek along the main channel border of the Ohio River. The creation of the "T" dikes would provide a

complex structure that would increase the diversity of submerged habitat, provide habitat heterogeneity, and create velocity shelters for fishes during all seasons. In addition to the added hard substrate, the altered water flow would also enhance habitat diversity.

These structures would be placed in a field of 10. Each structure would be randomly positioned 25 to 50 yards from the riverbank between ORM 372 and 373. An individual structure would be 60 feet wide and 50 feet long at the top. The structure would have 1.5 to 1 side slopes, and the overall dimension would be 75 feet by 75 feet. The dike will be toed into the sub-grade a minimum of two feet and stand above the channel bottom approximately five feet. All rip-rap material would be shipped by barge to the project site. All costs for shipping are included in the material costs. The size of the rock used will be uniformly graded limestone with each rock weighing between 50 and 150 pounds. Excavated material from site preparation can be disposed in the main river channel.

3.0 COST ANALYSIS

3.1 Introduction

This section presents the findings of a cost effectiveness and incremental cost analysis of No-Action and of the three alternatives under consideration. These cost analyses are not intended to determine the best alternative, but rather to provide decision-makers with a comparison of alternatives that produce different levels of environmental outputs and to assist in selecting the alternative that best satisfies project objectives. The analyses are intended to improve the quality of decision-making when considering alternative plans.

The cost effectiveness and incremental cost analysis was conducted in accordance with guidelines contained in EC 1105-2-206, entitled *Project Modification for Improvement of the Environment*, which is the same guidance as EC 1105-2-210, dated June 1, 1995, entitled *Ecosystem Restoration in the Civil Works Program;* EC 1105-2-214, dated October 3, 1998, entitled *Project Modifications for Improvement and Aquatic Ecosystem Restoration;* and Institute for Water Resources report *Evaluation of Environmental Investments Procedures Manual Interim: Cost Effectiveness and Incremental Cost Analyses,* dated May 1995 (IWR Report 95-R-1).

The Institute for Water Resources (IWR) has developed IWR-PLAN Decision Support Software to assist with the formulation and comparison of alternative plans of environmental restoration projects. IWR-PLAN assists in plan formulation by combining solutions to planning problems and calculating the additive effects of each alternative or combination of alternatives. When developing a combination of alternatives, IWR-PLAN includes each alternative in the combination, assigning either an action or no-action status to each. For instance, when evaluating a project with three alternatives, IWR-PLAN calculates total environmental output associated with implementing Alternative 1 as the output associated with implementing Alternative 1 plus the output (if any) associated with no-action under alternatives 2 and 3.

IWR-PLAN assists in plan formulation and comparison of alternatives by conducting cost effectiveness and incremental cost analyses. IWR-PLAN was used in conducting the cost effectiveness and incremental cost analyses for the Upper Twin Creek “T” Dikes Project.

As the name indicates, cost effectiveness analysis is a method for comparing alternative plans that produce environmental outputs and for determining which plan can produce the largest quantity of output for a given cost, or produce the same or greater quantity of output for less cost. Cost effectiveness analysis determines if: (1) the same environmental output level could be produced by another plan at less cost; (2) a larger environmental output level could be produced at the same cost; or (3) a larger environmental output level could be produced at less cost. For instance, if two alternatives produce the same amount of environmental outputs, the alternative with the lowest cost is considered cost effective. Likewise, if the costs of two alternatives are equal, but one produces more outputs than the other, the one producing the higher level of outputs would be the cost effective alternative. Also, an alternative that costs less and produces higher levels of output is considered to be cost effective compared to higher cost alternatives producing lower levels of output.

Incremental cost analysis builds on the findings of the cost effectiveness analysis. This is accomplished by comparing the increase in costs to the increase in outputs associated with advancing from one output level (one cost effective alternative) to the next higher output level (another cost effective alternative).

3.2 Cost Estimates of Alternatives

To conduct cost effectiveness and incremental cost analyses, the total cost of implementing each alternative must be estimated and stated on an average annual basis. Preliminary cost estimates for alternatives presented in the feasibility report were obtained from the Microcomputer Aided Cost Estimating System (MCACES) cost estimates developed as part of the feasibility report and additional cost elements (real estate, plans and specifications, and supervision and administration during construction). Cost estimates for alternatives developed as part of this analysis were based on MCACES per-unit costs presented in the feasibility report and calculated quantities.

3.2.1 Alternative 1. Construct 10 "T" Dikes. The total estimated cost associated with implementing Alternative 1 is $215,406 (Table 3-1). Activities included in these costs are equipment mobilization, riverbed excavation, and placement of rock revetments. Also included in the costs are contingencies, real estate costs, plans and specifications, supervision and administration during construction, and interest during construction. Interest during construction is based on the federal discount rate of 6.625 percent and a construction schedule of 55 days.

Table 3-1. Upper Twin Creek "T" Dikes Project, Alternative 1, Construct 10 "T" Dikes, Cost Estimate

Item	Costs
"T" Dikes Costs	
Mobilization	$15,000
Excavation	$2,389
Rock	$104,210
Contingencies	$8,512
Real Estate Costs	$54,225
Plans and Specifications	$15,000
S & A During Construction	$15,000
Cost Subtotal	$214,336
Interest During Construction	$1,070
Gross Investment	$215,406

Sources: Ohio River Mainstream Ecosystem Restoration Project – Feasibility Report; Louisville District, USACE; and G.E.C., Inc.

3.2.2 Alternative 2. Construct 20 "T" Dikes. The total estimated cost of Alternative 2 is $331,616 (Table 3-2). Activities included in these costs are equipment mobilization, riverbed evacuation, and placement of rock revetments. Also included in the costs are contingencies, real estate costs, plans and specifications, supervision and administration during construction, and interest during construction. Interest during construction is based on the federal discount rate of 6.625 percent and a construction schedule of 108 days.

Table 3-2. Upper Twin Creek "T" Dikes Project, Alternative 2, Construct 20 "T" Dikes, Cost Estimate

Item	Costs
"T" Dikes Costs	
Mobilization	$15,000
Excavation	$4,778
Rock	$208,420
Contingencies	$15,974
Real Estate Costs	$54,225
Plans and Specifications	$15,000
S & A During Construction	$15,000
Cost Subtotal	$328,397
Interest During Construction	$3,219
Gross Investment	$331,616

Sources: Ohio River Mainstream Ecosystem Restoration Project – Feasibility Report; Louisville District, USACE; and G.E.C., Inc.

3.2.3 Alternative 3. Construct 10 Large "T" Dikes. The total estimated cost of implementing Alternative 3 is $372,921 (Table 3-3). Activities included in these costs are equipment mobilization riverbed excavation, and placement of rock revetments. Other included costs are contingencies, real estate costs, plans and specifications, supervision and administration during construction, and interest during construction. Interest during construction is based on the federal discount rate of 6.625 percent and a construction schedule of 126 days.

Table 3-3. Upper Twin Creek "T" Dikes Project, Alternative 3, Construct 10 Large "T" Dikes, Cost Estimate

Item	Costs
"T" Dikes Costs	
Mobilization	$15,000
Excavation	$5,091
Rock	$245,779
Contingencies	$18,611
Real Estate Costs	$54,225
Plans and Specifications	$15,000
S & A During Construction	$15,000
Cost Subtotal	$368,705
Interest During Construction	$4,216
Gross Investment	$372,921

Sources. Ohio River Mainstream Ecosystem Restoration Project – Feasibility Report; Louisville District, USACE; and G.E.C., Inc., 2000.

3.3 Average Annual Cost

Table 3-4 presents a summary of the cost estimates for the three alternatives. The average annual cost of implementing each alternative, assuming a 50-year project life and a federal discount rate of 6.625 percent, is also presented. The average annual cost is the annual amount required to amortize the present value of project costs over the life of the project. It is equivalent to the annual payment needed to finance the project over 50 years at 6.625 percent interest.

The average annual cost of Alternative 1, Construct 10 "T" Dikes, is $18,718. This includes an average annual cost of gross investment of $14,872 and average annual operation and maintenance costs of $3,846. The operation and maintenance costs are based on costs of $52,200 expected to be incurred every 10 years during the life of the project for the repair of the rock structures. These costs are discounted to their net present value, then amortized over the life of the project.

The average annual cost of Alternative 2, Construct 20 "T" Dikes, is $30,587. This includes an average annual cost of gross investment of $22,896 and average annual operation and maintenance costs of $7,691. The operation and maintenance costs are based on costs of $104,400 expected to be incurred every 10 years during the life of the project. These costs are discounted to their net present value, then amortized over the life of the project.

Table 3-4. Upper Twin Creek "T" Dikes Project,
Summary of Construction and O & M Costs for Each Alternative

Item	Alternative 1	Alternative 2	Alternative 3
Gross Investment	$215,406	$331,616	$372,921
Annualized Gross Investment Cost	$14,872	$22,896	$25,748
Annualized O&M Costs	$3,846	$7,691	$9,069
Total Annualized Costs	$18,718	$30,587	$34,817

Sources: Ohio River Mainstream Ecosystem Restoration Project - Feasibility Report; Louisville District, USACE; and G.E.C., Inc., 2000.

The average annual cost of Alternative 3, Construct 10 Large "T" Dikes, is $34,817. This includes an average annual cost of gross investment of $25,748 and average annual operation and maintenance costs of $9,069. The operation and maintenance costs are based on costs of $123,100 expected to be incurred every 10 years during the life of the project. These costs are discounted to their net present value, then amortized over the life of the project.

3.4 Environmental Benefits

Environmental impacts associated with No-Action and each alternative were measured in habitat acres. Because of resource and time constraints, field surveys could not be conducted to define the impact of each alternative. Therefore, environmental impacts were estimated using information provided in the feasibility report. Extensive field surveys would be required to more accurately quantify the environmental impacts of each alternative.

3.4.1 Alternative 1. Construct 10 "T" Dikes. The aquatic habitat diversity occurring along the outer bend of the Ohio River immediately upstream of the Twin Creek confluence is extremely limited. In an attempt to increase aquatic habitat diversity in this portion of the river channel, construction of 10 "T" dikes at various depths and various distances from the bank but out of the navigation channel has been proposed. These "T" dikes would provide underwater structures, that would alter the water flow patterns, cause scouring effects downstream of the structures, and improve habitat diversity for a variety of aquatic organisms. Each "T" dike would provide approximately 0.04 acre of underwater structure. Therefore, the 10 "T" dikes alone would create approximately 0.4 surface acre of submerged hard substrate habitat. Estimates of habitat acres created by the rock revetments are based on the total amount of surface area of all of the revetments.

3.4.2. Alternative 2. Construct 20 "T" Dikes. Under Alternative 2, construction of 20 "T" dikes is proposed. These "T" dikes would be of the same design and size as those proposed in Alternative 1. The amount of aquatic habitat created by this alternative would increase to approximately 0.7 acre of submerged hard substrate habitat. Estimates of habitat acres created by the rock revetments are based on the total amount of surface area of all of the revetments.

3.4.3. Alternative 3. Construct 10 Large "T" Dikes. In order to provide the most habitat diversity per unit of cost, other alternatives have been proposed. Under this alternative, 10 "T" dikes

would be constructed; however the overall dimensions of the dikes would be 75 feet by 75 feet instead of 50 feet by 50 feet. The dikes constructed under this alternative would provide the same type of habitat diversity as the ones in Alternative 1. The amount of submerged hard substrate habitat created would be approximately 0.7 acre. Estimates of habitat acres created by the rock revetments are based on the total amount of surface area of all of the revetments.

3.4.4. Summary of Environmental Benefits. Implementing Alternative 1, Construct 10 "T" Dikes, would result in an average annual increase of 0.4 acres of habitat. Implementing Alternative 2, Construct 20 "T" Dikes, would result in an average annual increase of 0.7 acres of habitat. Implementing Alternative 3, Construct 10 Large "T" Dikes, would result in an average annual increase of 0.7 acres. No action for all three alternatives results in no significant environmental impacts.

3.5 Relationship Among Alternatives

The three alternatives cannot be effectively combined. The alternatives consist of varying the size or number of "T" dikes to be constructed between Ohio River mile 372 and 373. Therefore, only one of the alternatives can effectively be implemented. IWR-PLAN requires that each alternative be assigned costs and outputs associated with both implementing and not implementing the alternative. The cost for not implementing an alternative (No-Action) is $0. The environmental outputs associated with not implementing an alternative (No-Action) are the quantity of habitat that would be impacted (lost) over the life of the project if the alternative is not implemented. These values are calculated in terms of average annual impacts, which are the cumulative number of acres impacted each year by the project divided by 50, the number of years the project will exist. The No-Action outputs are entered into IWR-PLAN as negative values (lost habitat).

The cost of implementing each alternative is stated in average annual costs and includes construction costs and operation and maintenance costs. The environmental outputs associated with implementing each alternative are calculated as the quantity of habitat created by the alternative and the quantity of habitat protected from loss if the alternative were not implemented (the No-Action impacts). Because of the method that IWR-PLAN uses to combine alternatives to derive the various combinations of alternatives, the impacts associated with implementing the alternative must be entered into the program as net impacts. Net impacts for each alternative are calculated as the impacts associated with implementing the alternative minus the No-Action impacts.

When developing the combination of alternatives, IWR-PLAN includes each alternative in the combination and assigns either an action or no-action status to each. For instance, the IWR-PLAN derived output from implementing Alternative 1 is actually calculated as the combination of the net impacts of the action of Alternative 1 (0.4 acres) and the no-action impacts of Alternative 2 (0 acres) and Alternative 3 (0 acres), resulting in a combined impact of 0.4 acres.
Including No-Action, a total of four actual combinations of alternatives exist.

3.6 Cost Effectiveness Analysis

Cost effectiveness analysis is intended to illustrate which alternatives can produce the same amount of environmental output for less costs or a larger quantity of output for the same or less cost. Table 3-5 presents the average annual cost, annual environmental outputs, and average cost per output for each combination of alternatives. The cost-effective combinations are: No-Action, Alternative 1, and Alternative 2. These combinations are presented in bold type in Table 3-5.

Table 3-5. Upper Twin Creek "T" Dikes Project,
Cost Effectiveness Analysis

Alternative	Outputs (Acres)	Costs ($1,000)	Average Cost ($/Acres)
No Action	**0.0**	**0.00**	**0**
Alternative 1	**0.4**	**18.72**	**46,800**
Alternative 2	**0.7**	**30.58**	**43,685**
Alternative 3	0.7	34.82	49,743

Source: G.E.C., Inc.

3.7 Incremental Cost Analysis

Incremental cost analysis illustrates the increase in costs associated with advancing from one output level to the next higher output level. Table 3-6 presents the average annual cost, the annual environmental output, the average cost of output, the incremental output, and the total and per unit incremental cost of the "best buy" alternatives.

Table 3-6. Upper Twin Creek "T" Dikes Project,
Incremental Cost Analysis of Increasing Output from the No-Action Alternative
for the "Best Buy" Alternative

Alternative	Outputs (Acres)	Costs ($1,000)	Average Cost ($/Acres)	Incremental Cost ($1,000)	Incremental Output (Acres)	Incremental Cost Per Output ($)
Alternative 2	0.7	30.58	43,686	30,580	0.7	43,686

Source: G.E.C., Inc.

Alternative 2 is considered the "best buy" alternative, or the alternative that would generate the most output for any additional money expended. The average cost per habitat acre for Alternative 2 is $43,686, which is also the incremental cost per acre. A total of 0.7 beneficial habitat acres are produced under this alternative. The total annual incremental cost, the increase in costs from no-action, is $30,580

Alternative 2 generates 0.7 acre of habitat at a cost of $30,580. This equates to a cost of $43,686 ($30,580/0.7) per acre of output. The other cost-effective alternative, Alternative 1, produces a total

of 0.4 acre at a total cost of $46,800. This equates to a cost of $117,000 ($46,800/0.4) per acre of output. Alternative 2 produces more output at a lower per unit cost, making it a "better buy" than Alternative 1. For this reason, Alternative 2 is considered the "best buy" plan.

4.0 SUMMARY AND CONCLUSION

This report presents an incremental analysis on the Upper Twin Creek "T" Dikes Project, which is associated with a proposed ecosystem restoration program for the Ohio River. The Upper Twin Creek "T" Dikes Project is located in Scioto County, Ohio, approximately 14.5 miles southwest of Portsmouth, Ohio, and is in the Ohio River Meldahl Pool between Ohio River Mile (ORM) 372 and 373.

The primary goals of the Upper Twin Creek "T" Dikes project are to provide aquatic habitat diversity upstream from Upper Twin Creek and to provide velocity shelters for fishes in the Ohio River during winter and times of high flows. Increased habitat diversity would correlate with a sustained fishery resource and an improved recreational fishery. Three alternatives were evaluated as part of the project and include: Alternative 1, Construct 10 "T" Dikes; Alternative 2, Construct 20 "T" Dikes; and Alternative 3, Construct 10 Large "T" Dikes.

Under Alternative 1, Construct 10 "T" Dikes, a group of 10 "T" shaped boulder structures measuring 50 feet by 50 feet would be created upstream from Upper Twin Creek along the main channel border of the Ohio River. Under Alternative 2, Construct 20 "T" Dikes, a group of 20 "T" shaped boulder structures measuring 50 feet by 50 feet would be constructed at the site described under Alternative 1. Under Alternative 3, Construct 10 Large "T" Dikes, a group of 10 "T" shaped boulder structures measuring 75 feet by 75 feet would be constructed at the location described under Alternative 1. All three of these alternatives will, to varying degrees, increase submerged habitat and provide velocity shelters for fishes during all seasons.

The following subsections provide a summary of impacts, as well as the cost effectiveness analysis.

4.1 Environmental Benefits

4.1.1. Alternative 1. Construct 10 "T" Dikes. Constructing 10 "T" dikes upstream from Upper Twin Creek along the main channel border of the Ohio River will increase the diversity of submerged habitat and provide velocity shelters for fishes during all seasons. If this alternative is implemented, 0.4 acres of hard substrate aquatic habitat will be created. There will be no direct loss of habitat for no-action under this alternative.

4.1.2. Alternative 2. Construct 20 "T" Dikes. Constructing 20 "T" dikes upstream from Upper Twin Creek will increase the diversity of submerged habitat and provide velocity shelters for fishes during all seasons. If this alternative is implemented, 0.7 acres of hard substrate aquatic habitat will be created. There will be no direct loss of habitat for no-action under this alternative.

4.1.3. Alternative 3. Construct 10 Large "T" Dikes. Constructing 10 large "T" dikes upstream from Upper Twin Creek will increase the diversity of submerged habitat and provide velocity shelters for fishes during all seasons. If this alternative is implemented, 0.7 acre of hard

substrate of aquatic habitat will be created. There will be no direct loss of habitat for no-action under this alternative.

4.2 Cost Effectiveness and Incremental Cost Analysis

Cost effectiveness and incremental cost analyses were conducted for the combination of alternatives in order to provide decision-makers with information to choose the combination of alternatives that best satisfy project objectives. The environmental outputs of the alternatives were measured in habitat acres. Cost effectiveness analysis compares alternative plans that produce environmental outputs and determines which plan produces the largest quantity of output for a given cost, or produce the same or greater quantity of output for less cost. The cost-effective alternatives are: No-Action, Alternative 1, and Alternative 2.

Incremental cost analysis compares the increase in costs (of cost-effective alternatives) of advancing from one output level to the next higher level of output. The resulting "best buy" alternative is Alternative 2. The average cost per habitat acre for Alternatives 2 is $43,686, which is also the incremental cost per acre. A total of 0.7 beneficial habitat acres are produced under this combination. The total annual incremental cost, the increase in costs from No-Action, is $30.580.